MODERN CONCRETE REINFORCEMENT

A practical manual for architects and builders on concrete reinforcement and economical methods and materials for placing, supporting, spacing and holding reinforcement in concrete structures; ~ including notes on specifications and inspection methods.

CONCRETE STEEL CO.

A.I.A. File No. 4.

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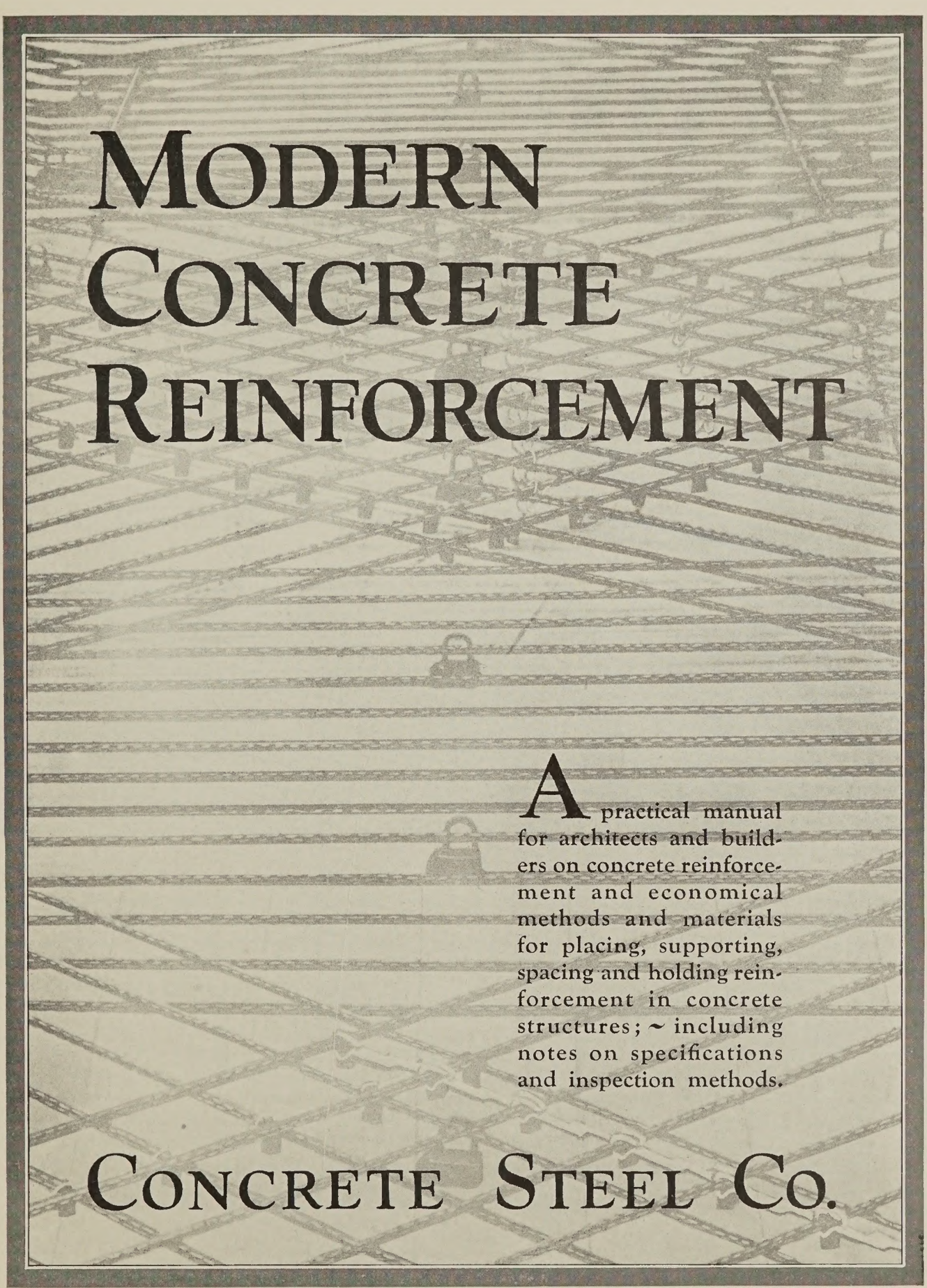
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The Camden Bridge Garage, facing the beautiful New Jersey plaza of the new Philadelphia-Camden Bridge, is an excellent example of fine architectural expression. This attractive building of concrete faced with brick is reinforced with Havemeyer Bars. It was constructed by Barclay, White & Co., builders, from the designs and under the supervision of The Ballinger Company, architects and engineers.

Modern Concrete Reinforcement

Correct Placement of Steel Reinforcement in Accordance with Engineer's Design Essential to Successful Concrete Construction. Economies Possible through Correct Field Practice of Importance to Builders and Architects.

THIRTY years ago, the design of reinforced concrete structures was an engineering science in its infancy. Today it is a full-fledged division of engineering, so well established as to be an exact science, no longer dependent upon trial and error methods, with strength and safety secured through ample factors of safety. Design theories have been refined and proved; design formulae have become standardized and wholly reliable. Modern reinforced concrete structures are the products of skilled designers working with known quantities and proved materials, erected by trained workers following construction methods developed through years of evolution and experience.

So rapid were the advances in reinforced concrete design and construction practices during the last two decades that those engineers, architects, and builders who were not constantly in touch with its developments often found themselves at a disadvantage in developing structures of this type. There was a tendency, apparent for many years, to avoid reinforced concrete construction and to give preference to more familiar structural systems even when the economy, flexibility, and other advantages of concrete construction were quite apparent. During this period a measure of specialization naturally took place. Some engineers and architects, and a group of progressive building organizations, specializing in reinforced concrete work, captured the desirable contracts through their recognized experience in this rapidly expanding field.

Today, however, the situation is changing again; the demand for reinforced concrete has largely forced those engaged in building design and construction to become proficient in its use at the risk of losing both a profitable business and their reputation as capable and versatile designers and builders. Both design and construction methods have become firmly stabilized; really new developments are comparatively few; and authoritative information and instructions are being widely disseminated by such powerful and impartial agencies as the Concrete Reinforcing Steel Institute, the American Concrete Institute, the Engineering Standards Committee, the Society for Testing Materials, the Bureau of Standards, and the leading Engineering Societies. Today it is imperative that architects be familiar with reinforced concrete construction, and if not fully competent in its design, then at least sufficiently versed in its use properly to supervise its construction when the design has been prepared by consulting engineers. Today it is equally imperative that builders be fully competent to carry out reinforced concrete construction either for entire buildings and public works, or for minor elements thereof, if they hope to retain their place under modern conditions.

Reinforced concrete is essentially a scientific combination of mass concrete, which has high compressive and relatively low tensile strength, with steel, which has high tensile and compressive strength, to form structural members having definite load carrying capacities involving both tension and compression in their various parts. The proportioning of the steel reinforcement to the concrete mass, and particularly the disposition of the steel in the structural member are the basic problems of design.

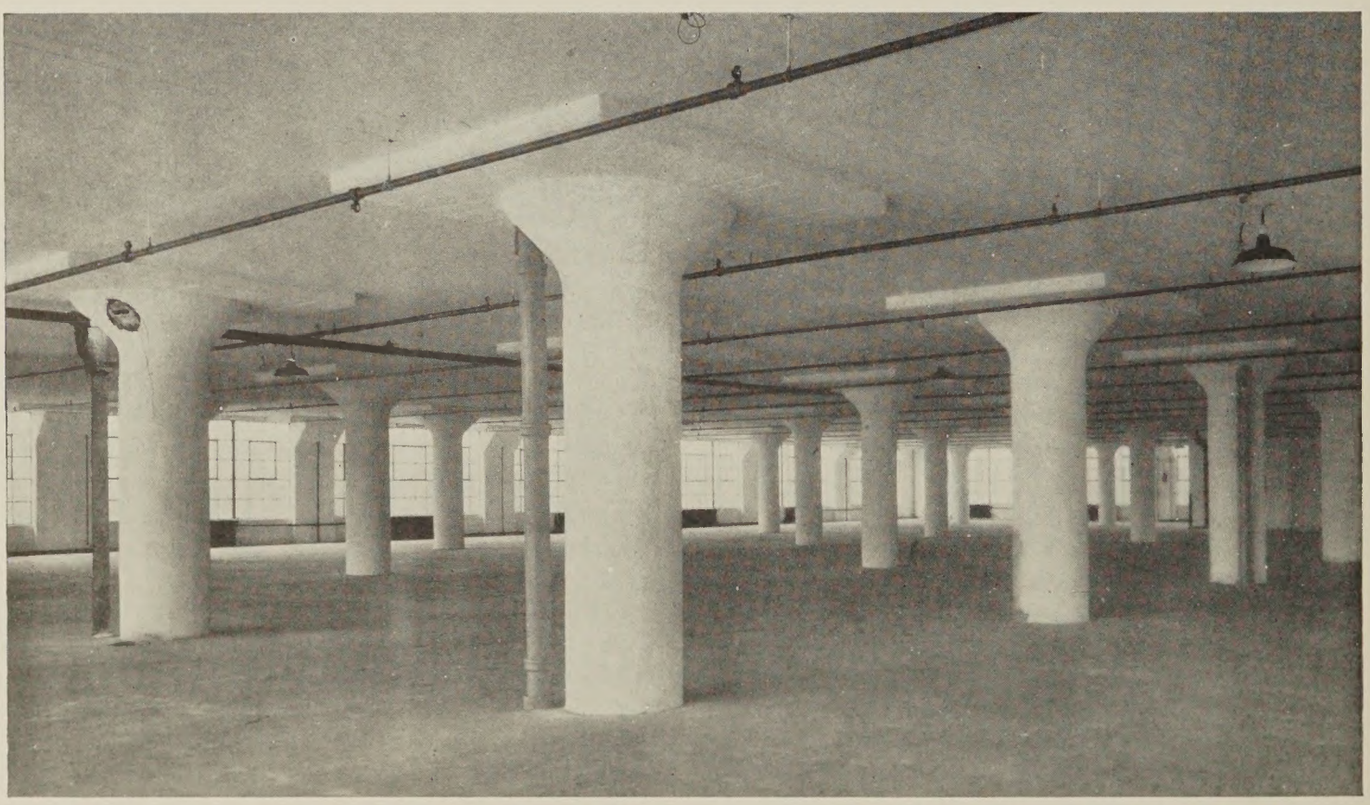
The importance of correct placement of steel reinforcement in concrete structural members cannot be over-emphasized. In some parts of a beam there are no tensile stresses; in other parts they far exceed the tensile strength of concrete. If the steel designed to meet these stresses be out of place, though otherwise adequate, the member will lack its designed load carrying capacity and may fail. Engineers make hundreds of involved calculations to determine the amount of steel required, *all based on the assumption that it will be placed in exact accordance with their designs.* The placement of steel and its quantity are inter-related factors; if one changes, the other must change. Failure to locate steel reinforcement in accordance with the engineer's design is as hazardous as to lessen the quantity of steel or to impose an excessive load upon the member.

After a correct design has been developed—a matter of precise mathematical computation based on established methods and formulae—the creation of a successful structure, having its full load carrying capacity and a proper margin of safety, depends upon the care with which the builder places the steel reinforcement and holds the elements in place so that they will function correctly.

In this book we are concerned with two problems only; the technique of placing and holding steel reinforcement, and the methods of inspection that will enable the designer or architect to satisfy himself that the steel will function as designed.

The placing, spacing and holding of steel reinforcement is the direct concern of both the designer (engineer or architect) and the builder, and ultimately it is of paramount importance to the owner.

Typical beam and girder construction in reinforced concrete garage. Note the heavy girders supported by columns, which, in turn, carry the slightly smaller beams and the floor slab. The reinforcement of this type of construction is described on pages 13 to 18 inclusive.



Typical flat slab construction in a reinforced concrete factory. Note particularly the mushroom headed columns with the square column drops supporting the continuous flat slab. This construction requires less headroom than beam and girder. Its reinforcement is described on pages 18 to 22 inclusive.

What is "Havemeyer Reinforcement"?

A Combination of Materials, Methods and Service for the Economical and Scientifically Correct Placement of Reinforcement in Concrete Construction.

HAVEMEYER REINFORCEMENT is the general name comprehending a new type of service, a new combination of structural materials, and a new and simplified technique, all devoted to the correct and economical reinforcement of concrete structures. The function of Havemeyer Reinforcement is fourfold: (1) To assure designers, builders and owners of the correct reinforcement of concrete members in exact accordance with structural designs and computations. (2) To simplify placement methods and reduce construction costs. (3) To centralize responsibility for the correct execution of structural designs in reinforced concrete. (4) To simplify the inspection of concrete reinforcement by architects and engineers.

There are, of course, many methods in use of securing the correct placement of reinforcing steel in concrete structures. Havemeyer Reinforcement makes no exclusive claims, but possesses the value of consistency, uniformity, and simplicity, due to the fact that all elements are designed to function together and are readily available through a single source. It seeks to achieve the maximum economy of labor and cost compatible with sound engineering standards. The following brief description of the component elements of Havemeyer Reinforcement will serve to indicate its value to owners and their architects, engineers and builders, and to demonstrate its importance as a logical and sound development in construction practice.

Materials. The structural elements of Havemeyer Reinforcement are: Havemeyer Bars and Spirals, and Havemeyer Supporting, Holding and Spacing devices. Havemeyer Bars are deformed reinforcing bars of recognized quality which have long been accepted as standard in the building industry. Their particular characteristics are fully described in the following chapter. Havemeyer Collapsible Spirals are made of round rods and special spacing bars, to which Havemeyer deformed bars are added for vertical reinforcement of columns. Havemeyer Supporting, Holding and Spacing devices are scientifically designed specialties employed to assure the correct placement of bars in the forms, and to hold the bars rigidly during the process of pouring the plastic concrete mix,—entirely eliminating the possibility of misplacing or displacing the reinforcing steel. On page 9 will be found a brief description of the various devices and specialties employed in Havemeyer Reinforcement.

Methods and Economies. Second in importance only to the materials employed is the method of placing reinforcing steel and holding it in place until the concrete is poured and set. An essential part of Havemeyer Reinforcement, therefore, is the correct use of suitable Supporting, Holding and Spacing devices—following prescribed methods of handling steel reinforcing—to carry out the engineer's structural design in exact accordance with the computations (upon which the strength and the factor of safety of structural members depend). The standards for placing reinforcement developed by the Concrete Reinforcing Steel Institute are the foundation of the Havemeyer Reinforcement system, the only deviations permitted being those which may be required on a particular project due to the operation of local building codes and regulations, or to the special requirements of the architect or structural engineer who is responsible for the design.

Services. When Havemeyer Reinforcement is specified a definite group of correlated services is made available to the owner, architect and builder.

These services are described in detail in subsequent chapters, and include the following:

(1) Engineering design and erection details as ordered or required.

(2) Scheduling of materials and their delivery to meet job conditions.

(3) Cutting, Bending and Fabricating of reinforcement as ordered.

(4) Deliveries, when and as wanted. "Airspeed" service.

Centralized Responsibility. The adoption of Havemeyer Reinforcement centralizes the responsibility for the correct preparation of structural designs in the Concrete Steel Company with respect to the provision of the correct materials and the necessary supporting, holding and spacing devices required for the proper placement of reinforcement; and in the builder for the execution of the work in accordance with the standards established in this book and in the data sheets issued by Concrete Steel Company, and made a part of every shipment of Havemeyer reinforcing materials.

Field Inspection. The use of Havemeyer Reinforcement greatly simplifies the problem of field inspection. The use of prescribed Supporting, Holding and Spacing devices reduces inspection methods

Havemeyer Reinforcement is adapted to special reinforced concrete construction problems such as the one illustrated above, as well as to the standard types more frequently encountered. The illustration shows a concrete roof and special columns carrying crane rails in the die shop of an automobile body plant.

to (a) checking at one place the clearances of the devices themselves; (b) checking the use of the devices in accordance with the practice recommended in this manual; and (c) checking the sizes of the bars installed and seeing that the number called for are in place, and (d) testing for rigidity.

The following chapters are devoted to the materials and standards employed in Havemeyer Reinforcement. This manual thus becomes a field manual for the use of the builders and superintendents on the job; an inspector's manual for checking the execution of the work; and a specification manual for the use of the architects and engineers in the preparation of drawings and specifications. No attempt is made to present in this hand book the principles of reinforced concrete design. Reference to the "Code of Standard Practice" and "Design Standards" of the Concrete Reinforcing Steel Institute, and to the "Concrete Manual" of the Portland Cement Association for the design of concrete mixtures and concrete control, is recommended.

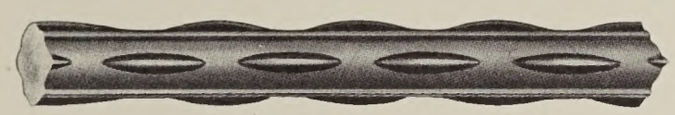
It may be noted here that the present day custom of buying reinforcing steel independently of Supporting, Holding and Spacing devices, and the frequent omission from specifications of detailed instructions with regard to the use of proper reinforcing specialties has permitted the employment of all sorts of slipshod methods for holding reinforcement in place, which are wholly inadequate to secure satisfactory results, and are inconsistent with the care and precision exercised in developing the structural design. Close competition and the lack of proper standards sometimes force contractors and builders, even against their better judgment, to resort to occasional hand-tying, the use of temporary wood or concrete blocks, and other unsafe substitutes for spacing devices; and frequently to disregard altogether the designed clearances and spacing of bars. This practice imposes an unnecessary burden upon the architect and engineer for close supervision, and introduces the possibility of ultimate displacement of reinforcement when concrete is poured, which no amount of inspection and supervision can overcome. By specifying Havemeyer Reinforcement as a complete entity, the last step is taken to aid the correct execution of the design with actual economy to the builder in time and labor, and to the architect and engineer in supervision.

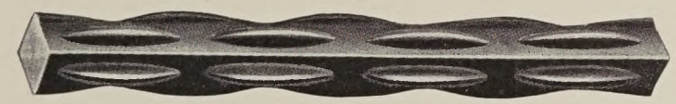
I. Havemeyer Bars of Constant Cross-Section

Havemeyer Deformed Bars, Giving Proper Anchorage in Concrete without Requiring Extra Metal, Save Weight and Cost. Havemeyer Collapsible Spirals for Columns Simplify Handling.

HAVEMEYER Bars are scientifically designed reinforcing members of new billet steel having longitudinal deformations of special design which contribute directly to the tensile resistance of the bar, no extra metal being used for mechanical bond only. Thus Havemeyer Bars provide the full mechanical bond of a deformed bar though *rolled to the same weight, area and strength of a plain bar.*

Havemeyer Bars are carried in stock in round and square forms, meeting the current specifications of the American Society for Testing Materials for new billet reinforcing bars.





Havemeyer reinforcing bars are deformed bars of constant cross-section. They are available in rounds and squares and can be had in flats on special order.

On all Havemeyer Bars the projections and depressions run longitudinally and rise and fall gradually, thus allowing a free and uninterrupted flow of metal while being rolled and permitting close adhesion of the plastic concrete at all points of the bar surface. Under the standard conditions of embedment required by modern design practice, the mechanical bond offered by the deformation is adequate to develop the full strength of the bar, with a wide margin of safety. The shape of the deformations eliminates any tendency to twist under stress.

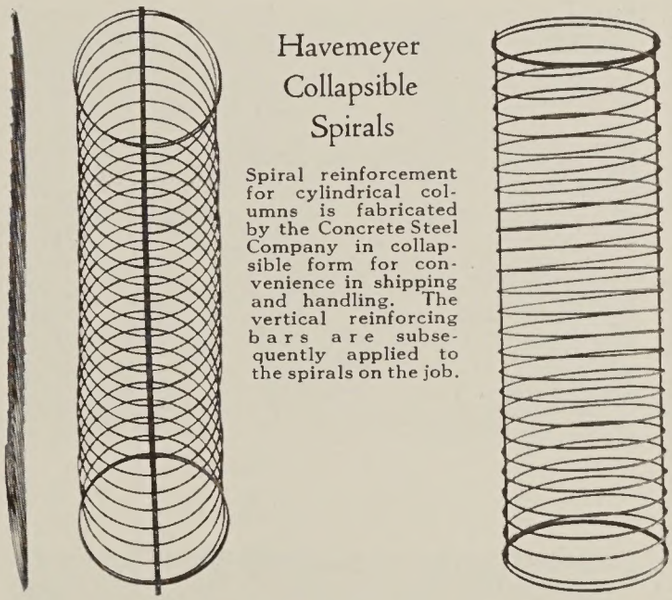
Havemeyer Bars are rolled in the sizes given in the preceding table which are those recommended by the Division of Simplified Practice of the Department of Commerce in Bulletin No. 26, December 15, 1924.

Havemeyer Bars rolled in following sizes:

Size Round or Square	Sq. In. Area	Lbs. Per Ft.	Extra for Size per 100 Lbs.
1¼″ sq.	1.563	5.313	Base
1⅛″ sq.	1.266	4.303	Base
1″ sq.	1.000	3.400	Base
1″ rd.	.785	2.670	Base
⅞″ rd.	.601	2.044	Base
¾″ rd.	.442	1.502	Base
⅝″ rd.	.307	1.043	10c
½″ sq.	.250	.850	20c
½″ rd.	.196	.668	20c
⅜″ rd.	.110	.376	40c
¼″ rd.	.049	.167	$1.00

HAVEMEYER COLLAPSIBLE SPIRALS

Another important reinforcing element is the Havemeyer Collapsible Spiral employed in columns. This unit consists of spiral coils of plain round rods made up with two or more channel spacers so attached to the spirals that the unit may be collapsed for shipment and handling. The vertical bars are set in place on the job and are clipped to the spirals usually before the complete unit is set in the form.



Havemeyer Collapsible Spirals

Spiral reinforcement for cylindrical columns is fabricated by the Concrete Steel Company in collapsible form for convenience in shipping and handling. The vertical reinforcing bars are subsequently applied to the spirals on the job.

Havemeyer Spirals are made with rods of the following standard sizes, areas and weights as recommended by the Division of Simplified Practice of the Department of Commerce, in their Bulletin No. 53, dated October 15, 1926.

Size	Area (Sq. In.)	Weights (Lbs. Per Foot)
¼″ round	.049	0.167
⅜″ round	.110	0.376
½″ round	.196	0.668
⅝″ round	.307	1.043

SUPPORTING, SPACING AND HOLDING DEVICES

for Correct Placement and Rigid Holding of Havemeyer Bars.

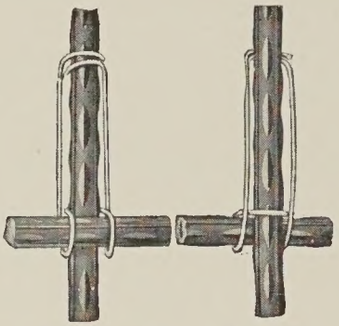
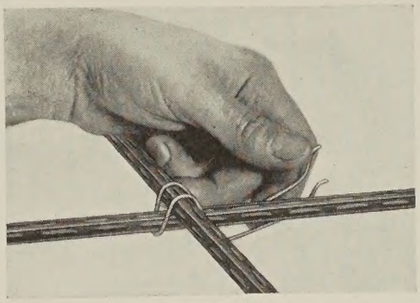


Fig. 1. No. 2 Bar-Ty



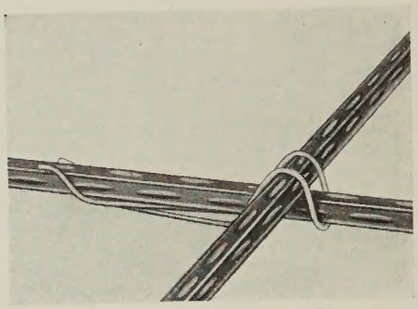


Fig. 2. No. 4 Bar-Ty

Bar-Tys are used to tie intersecting bars that are supported by other devices.

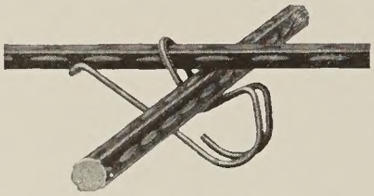
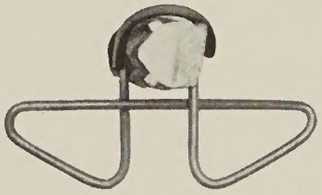


Fig. 3. Ty-Chair

Used to tie and support intersecting bars.



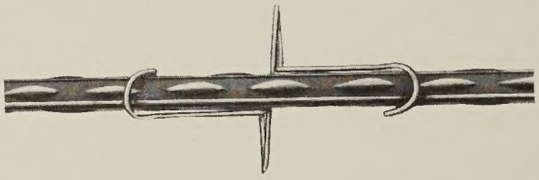


Fig. 4. Single Easel Chair

Used to support a single bar in ribs or small beams.

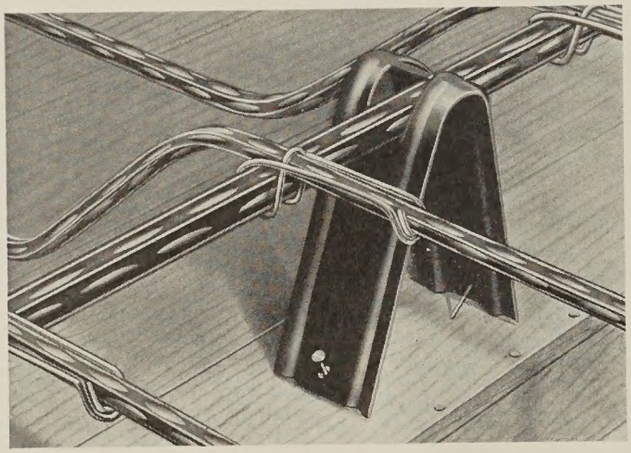


Fig. 5. Hy-Chair

Supporting a "Raising-Rod" or "Head-Rod" which is shown carrying Bent Bars. Note use of No. 2 Bar-Tys.

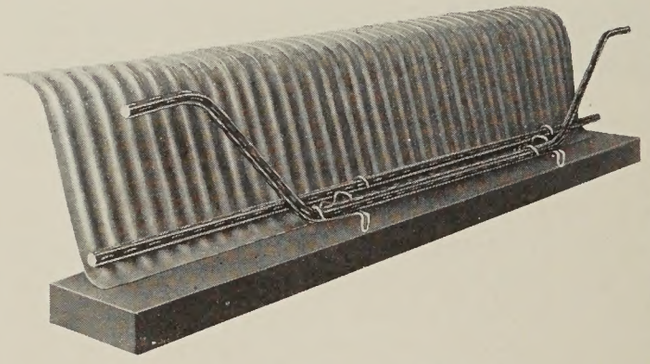


Fig. 6. Double Easel Chair

Used to hold, support and space two bars in beams.

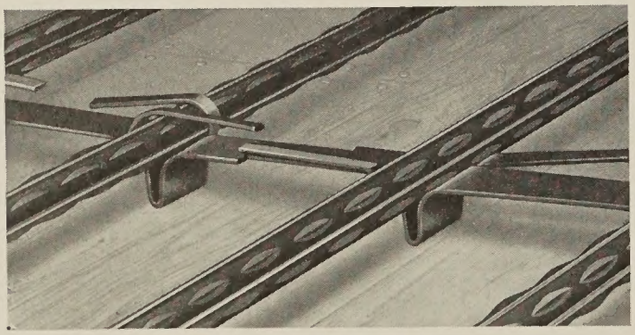


Fig. 7. Securo Bar-Spacer

Used to support, space and hold parallel bars in bottom of slabs.

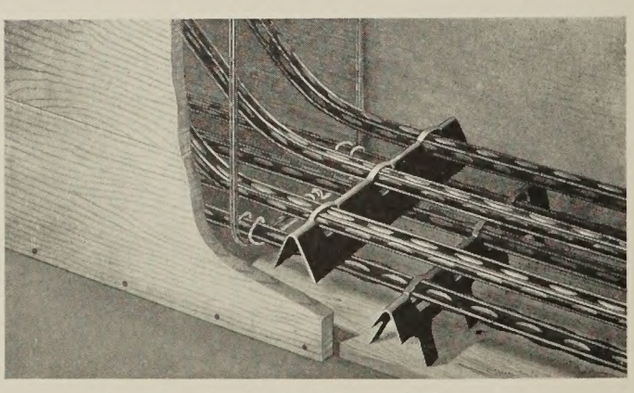


Fig. 8. Beam Saddle and Separator

Used to hold, support and space more than two bars, and to separate layers of bars in beams.

II.—Supporting, Spacing and Holding Devices

These Scientifically Designed Labor Saving Specialties are Essential Elements of the Complete Havemeyer Reinforcing System.

THROUGH long experience in actual concrete construction, a complete series of scientifically designed supporting, holding and spacing devices have been developed which meet every requirement for holding reinforcing steel in place.

On the opposite page are illustrated the principal devices used in securing Havemeyer Bars in beams, girders, slabs and columns. In a subsequent chapter of this manual the specific application of each of these devices is fully explained.

The following brief description of Havemeyer supporting, holding, and spacing devices will show their general functions.

Havemeyer Bar-Tys

Two types of bar-tys are manufactured, called No. 2 and No. 4. They are both used for tying reinforcing steel at any place on the job. They are used much more rapidly than pliers and soft wire and hold with far greater security. They are made from the highest grade spring steel wire and are made in all sizes to tie different combinations of bars. The No. 2 Bar-Ty has the stronger grip, completely wrapping both bars, while the No. 4 Ty is amply strong to resist displacement and can be more rapidly applied, especially where space is limited.

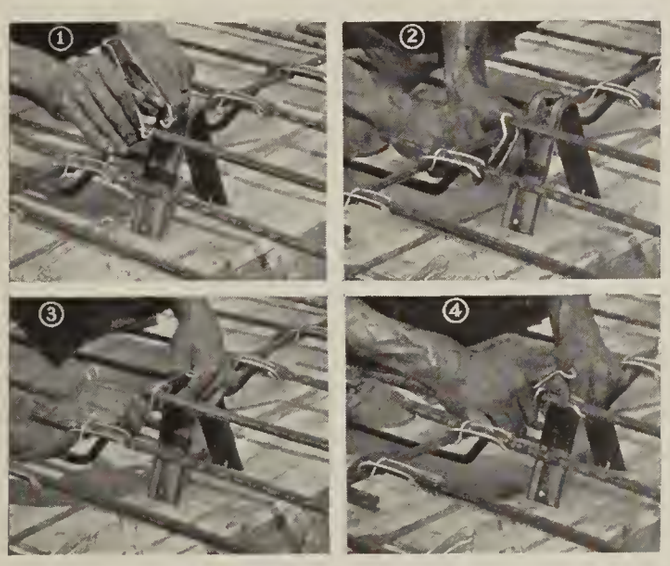


Fig. 9. No. 2 Bar-Tys Are Easily Applied

Havemeyer Ty-Chairs

These devices are used to support and tie slab reinforcing steel at intersections. They combine the functions of a Bar-Ty with a chair which holds the rods at the required distance above the form. They are made in all sizes with the standard lift of one inch (1″) and can be had to order with special lifts ranging from one-half inch (½″) to two inches (2″).

Havemeyer Hy-Chairs

These are used for holding raising rods which support bent slab bars over column heads, over intermediate bands in "two-way" flat slab construction, and over beams and girders. They are made of hoop steel, beaded for strength and punched with a locking prong and nailing holes. They are absolutely rigid and ample in strength to hold the entire reinforcement system firmly in place and at the proper height above the forms. They are made in any height to order and in standard heights from one and one-half inch (1½″) to eight inches (8″) in steps of one-half inch (½″).

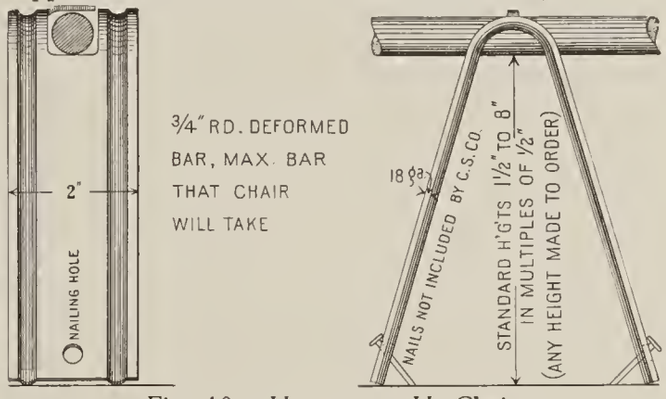

2″
NAILING HOLE
¾″ RD. DEFORMED BAR, MAX. BAR THAT CHAIR WILL TAKE
18 ga.
NAILS NOT INCLUDED BY C.S.CO
STANDARD H'GTS 1½″ TO 8″ IN MULTIPLES OF ½″ (ANY HEIGHT MADE TO ORDER)

Fig. 10. Havemeyer Hy-Chair

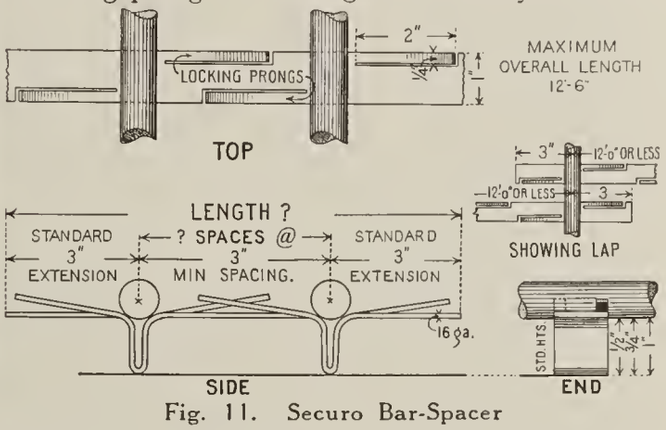


Fig. 11. Securo Bar-Spacer

Securo Bar-Spacers

These devices support, space and hold reinforcing steel in slab construction. They keep the bars at the

proper height above the forms at a uniform spacing in accordance with the engineer's design, and firmly hold them against possibility of displacement while

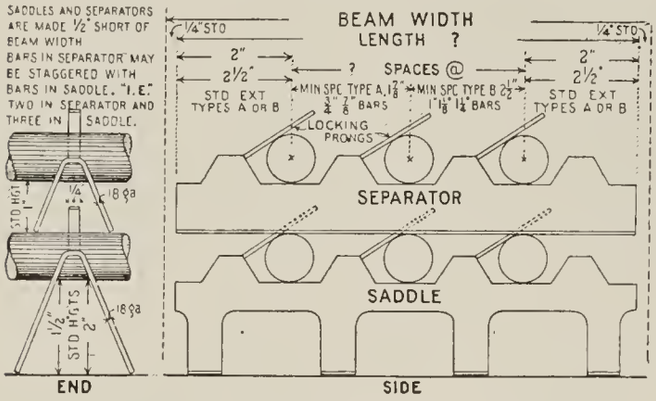

SADDLES AND SEPARATORS ARE MADE ½" SHORT OF BEAM WIDTH
BARS IN SEPARATOR MAY BE STAGGERED WITH BARS IN SADDLE. "I.E." TWO IN SEPARATOR AND THREE IN SADDLE.
BEAM WIDTH
LENGTH ?
¼" STD
2"
2½"
? SPACES @
STD EXT TYPES A OR B
MIN SPC TYPE A, 1⅜" BARS
MIN SPC TYPE B 2½" 1⅛" 1¼" BARS
LOCKING PRONGS
SEPARATOR
SADDLE
STD HGTS 1" 1½" 2"
18 ga
END
SIDE

Fig. 12. Beam Saddle and Separator

the slab is being poured. They are made up to meet requirements. Standard heights are one-half inch (½″), three-quarter inch (¾″) and one inch (1″).

Havemeyer Beam-Saddles and Separators

The beam-saddle is made of hoop steel and is used for supporting, spacing and holding reinforcing steel in beams and girders. The legs of the saddle give the required lift above the bottom of the beam, the standard heights being one and one-half inches (1½″) and two inches (2″). Beam separators are identical with beam-saddles, except they have no legs and are used to support the upper layers of bars in beams and girders separating each layer by one inch. The locking prongs hold the bars in position while allowing the concrete to bond perfectly.

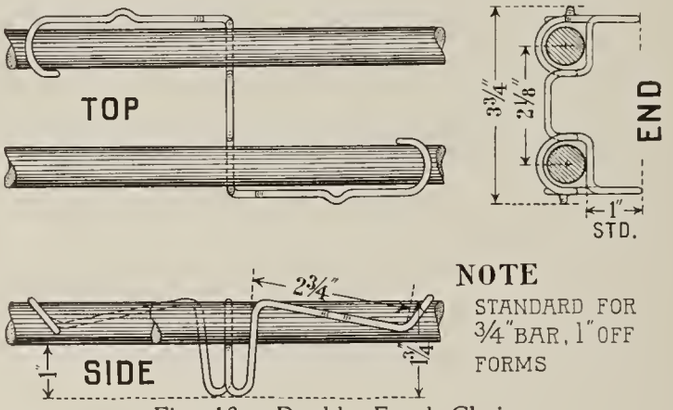


Fig. 13. Double Easel Chair

Havemeyer Easel-Chairs

These are special devices used for supporting and spacing one or two bars in a concrete joist between steel or hollow tile centers. The standard lift is one inch (1″) above the form. Special easel-chairs are made to order for any bar spacing and lift.

Each of these devices plays a definite part in the complete Havemeyer Reinforcement System, functioning to save costs in handling and placing the reinforcing bars and to assure correct spacing in accordance with the established design.

Fig. 14. Part of one of the Concrete Steel Company shops where Havemeyer Supporting, Spacing, and Holding devices are fabricated both in stock sizes and in sizes to meet individual job requirements. Securo Bar-Spacers are being manufactured in the foreground.

III. Fundamental Requirements in Placing Reinforcement

Practical Considerations which Govern the Placing and Protection of Steel in the Concrete Mass, Making Rigid Supports and Holding Devices Necessary.

ARCHITECTS and builders are thoroughly familiar with the merits and advantages of reinforced concrete construction and are equally well informed of the practical problems which arise in connection with its use. Among them are two fundamental requirements which govern the placing of the steel reinforcement in concrete members: (1) The embedment of the steel for protective purposes; (2) The correct disposition of the steel to conform with the designer's computations and layouts.

Whenever steel is employed as a structural material in fireproof buildings, it must be protected from the action of both weather and possible fires. These requirements hold true for steel framed skyscrapers as well as for reinforced concrete buildings. In structural steel fireproof buildings the columns, girders and beams are always completely enclosed in concrete or other masonry for fire protection and to prevent deterioration. In concrete work the steel reinforcement must be similarly surrounded by concrete for the same reasons. When properly constructed, reinforced concrete structures are practically immune to natural deterioration; but if carelessly constructed, with the reinforcement haphazardly disposed, they are subject to the same destructive forces which affect all other types of buildings.

The adequate embedment of reinforcing steel must be recognized as a primary consideration in all reinforced concrete work. There are various requirements for the protection of bars and spirals, depending on the position and type of member, and upon the degree of exposure to possible fire and the attack of the elements. Generally speaking, a minimum covering of two inches of concrete is required for exterior members and three inches under steel in the bottom of footings. Typical standards recommended by the Concrete Reinforcing Steel Institute are shown on the following page.

Somewhat less protection is required for members within a building where exposure to the weather is not present. Here the problem resolves itself in the matter of protection against fire and against the condensation of moisture or injurious fumes resulting from certain manufacturing processes.

Whatever method of placing reinforcement may be employed, it is essential to the permanency and quality of the structure that the reinforcing bars be properly embedded and this requirement involves the employment of supporting, holding and spacing devices of some type which will fix the steel in its proper location and prevent displacement of the reinforcement during the process of pouring the concrete and tamping it in the forms. If the supporting, spacing and holding devices do not function properly, the discovery of their failure can only be made after a number of years of exposure to the weather, or after a serious exposure to fire when rusting or buckling of the steel causes spalling of the protecting envelope of concrete and reveals the lack of adequate embedment.

A second primary consideration in placing reinforcement of even greater importance than the first, is the location of the bars in exact accordance with the original structural design. All engineers and architects familiar with the design of reinforced concrete structural members appreciate the refinement to which design formulae have been carried and the variation in ultimate strength which occurs in structural members when the relative position of the reinforcing elements is modified even to a relatively slight degree. Originally the adequacy of reinforced concrete was assured by the use of extra steel and extra concrete whenever the slightest doubt existed as to the reliability or adequacy of the design formulae employed. Due to the extreme precautions which were taken during the years when this type of construction was still in the development stage there were very few failures of reinforced concrete structures. Today, however, designs are more precise, stresses used in designs are being raised, and competitive conditions do not permit wasting steel or concrete to compensate for inaccurate execution in the field. Precise and economical methods must be used in the placing of reinforcing members if the designed strength and factor of safety are to be present in the completed structure.

Here, again, the employment of effective supporting, holding and spacing devices is of the utmost importance. Misplacing reinforcing bars in a structural member is equivalent to using less than the required area of steel.

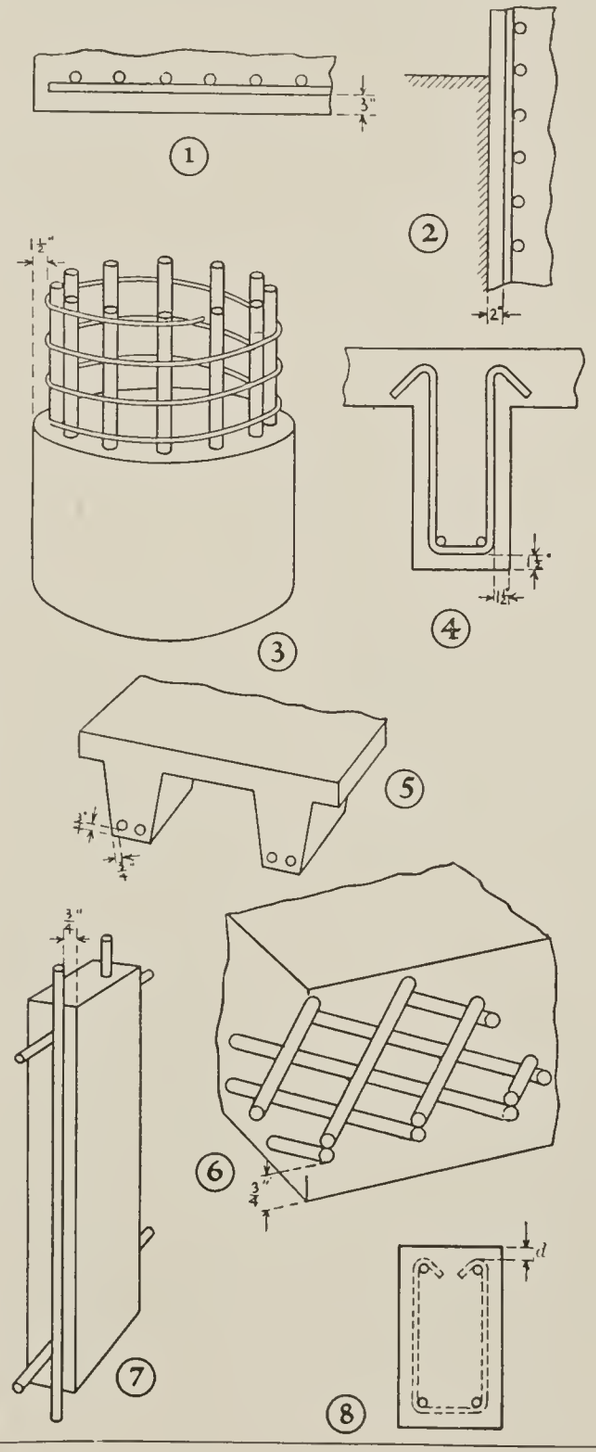
These two fundamental requirements in placing

reinforcement, the proper embedment of the steel for protection against fire and weathering, and the proper location of the steel in accordance with structural design, are both wholly satisfied by Havemeyer Reinforcement, which requires as an essential feature the use of scientifically developed Havemeyer supporting, spacing, and holding devices. This matter is developed in detail in the following chapter, and in the two accompanying data sheets.

The diagrams presented on this page show the standard minimum requirements for the protection of reinforcing steel in concrete as established by the Concrete Reinforcing Steel Institute, and as adopted as standard for Havemeyer Reinforcement.

MINIMUM STANDARDS FOR THE PROTECTION OF CONCRETE REINFORCEMENT

Concrete Reinforcing Steel Institute



Bars Shall be Properly Embedded—All reinforcing steel shall have a protection of concrete not less than the following:

1. Three inches (3″) on bottoms of footings.
2. Two inches (2″) where concrete is exposed to action of weather or ground.
3. One and one-half inches (1½″) over all reinforcement in columns.
4. One and one-half inches (1½″) on the bottom and sides of beams or girders.
5. Three-fourths inch (¾″) on bottoms and sides of ribs and bottoms of all floor slabs.
6. Three-fourths inch (¾″) on bottoms of all flat slabs.
7. Three-fourths inch (¾″) from the faces of all walls not exposed to action of weather or ground.
8. One (1) diameter over all bars at the upper face of any member.

IV. Practical Methods of Placing Reinforcement

Standard Field Practice Employed with Havemeyer Reinforcement Follows Closely the Specifications and Standards of the Concrete Reinforcing Steel Institute, and Develops Maximum Economy and Speed in Construction Work.

THE methods of placing, supporting, spacing and holding steel reinforcement in concrete construction described in the following pages are based upon long practical experience in actual concrete construction work and represent the most advanced and economical practice in this field. The number and size of Havemeyer Bars to be employed in any given structural member are, of course, dictated by the design, and nothing given in these pages should be assumed to affect or influence the structural design in any manner.

These methods are also the standards established for Havemeyer Reinforcement. *When Havemeyer Reinforcement is specified in its complete form,* the practices recommended in the following paragraphs are made a part of the specifications by reference and the contractor is required to follow them. The bill of materials prepared by Concrete Steel Company engineers under these specifications will include, unless otherwise specifically directed and ordered, the necessary quantity of each type of supporting, holding and spacing devices to permit placing the Havemeyer Bars in the manner described.

Where Havemeyer Reinforcement is not specified but the contractor or architect desires to use Havemeyer Bars and Supporting, Holding and Spacing devices, buying each desired item separately, the methods and practices outlined below are recommended, and if followed will produce the most satisfactory results and achieve the greatest economy.

Standard Practice for Placing Havemeyer Reinforcement

THE methods described below shall be followed in placing Havemeyer Reinforcement, consisting of Havemeyer Bars and Spirals and Havemeyer Supporting, Spacing and Holding devices as noted, unless: (1) The specifications particularly define variations from this practice; (2) Building Codes and regulations specifically require additional supports or spacers; and (3) local labor regulations specifically prevent the use of the time and labor saving devices and methods recommended; in which events the departure from these methods shall be only to the extent required by these governing factors. Since the methods comply with the requirements and standards of the Concrete Reinforcing Steel Institute developed jointly with the American Concrete Institute, they will be found acceptable to most building codes and regulations.

In all cases, except where noted in detail, the number of supporting, spacing and holding devices called for herein shall be the minimum number that may be used in compliance with Havemeyer Reinforcement Standards.

1. COLUMNS

Columns with Spiral Hooping.

The Concrete Reinforcing Steel Institute specifications require spacers in column spirals as follows:

Core Diameter (Outside to Outside)	Number of Spacers
Over 0″ to 24″	2
Over 24″	3

Havemeyer Collapsible Column Spirals are made with two spacers in place for all sizes with additional spacers shipped in the same spiral unit as required by the size of the column. This permits shipping and storing the spirals flat. When ready to use, open the spirals, add the extra spacers if and as required, and then insert the vertical Havemeyer Bars as called for in the structural design, and clip to the spiral bands at uniform intervals.

The vertical bars are most economically clipped to the spiral hoops with Havemeyer No. 2 Bar-Tys, as shown in the illustrations for setting up rectangular columns, Figs. 15 and 16.

Assembled spirals of light weight are then lifted above the column form and lowered into place. With heavy column reinforcement some of the bars are usually added after the spirals are in place.

Rectangular Columns.

For convenience in handling, the collapsible type of rectangular column assembly is recommended but not required. These columns may be assembled in the field as described below or they may be ordered from Concrete Steel Company assembled in collapsible form. (A special order should be included in the contract when shop assembly is desired.)

In field assembly follow the method illustrated in Figs. 15 and 16, using Havemeyer No. 2 Bar-Tys as shown. In order to collapse the column the Bar-Tys must all be in the *same plane,* i. e., all locked to the column bands either vertically or horizontally. Also

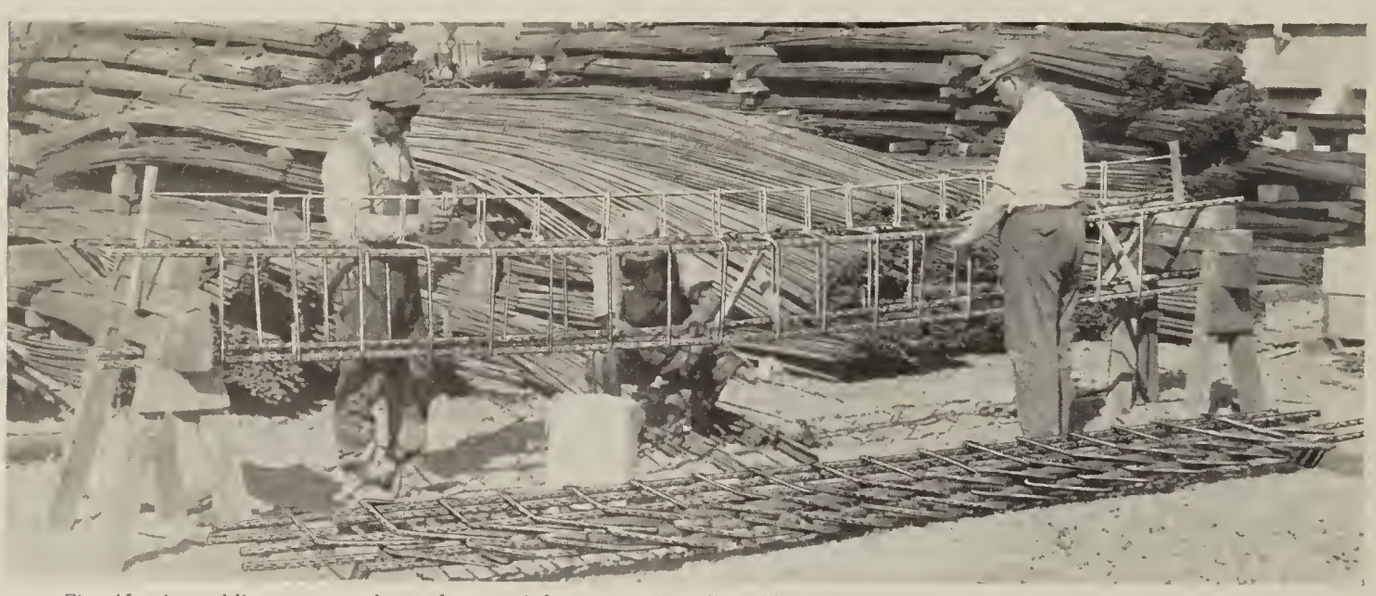


Fig. 15. Assembling rectangular column reinforcement in collapsible frames on the job. The horizontal column bands are tied to the vertical bars with No. 2 Bar-Tys, all arranged in the same plane, permitting the completed frame to be collapsed for storage and handling as shown in the foreground. Note the wire on which the Bar-Tys are hung for convenience of the workmen.

the laps of the column bands at corners must be *bent at right angles.* For additional strength these laps may be staggered along the column bars. Place *two Bar-Tys* at the points of lap and one at each of the other corners. When the column is collapsed the Bar-Tys, while holding firmly, allow the bands to swivel, as shown in the illustrations.

If more than four vertical Bars are used, a rigid assembly is necessary, which is constructed in the same manner on the job, using No. 2 Bar-Tys; or the collapsible type may be first built up or ordered shop-assembled, and the additional bars set in and clipped at the job as in the case of Havemeyer Collapsible Spirals, before or after setting the column reinforcement in its place.

2. HEAVY BEAMS

(Beams or Slabs with Large Number of 1⅛" or 1¼" Bars.)

The Concrete Reinforcing Steel Institute specifications require "Beam Chairs" (equivalent to Havemeyer Beam Saddles and Separators) as follows:

Beams or Slabs with Large Number of 1⅛ or 1¼-Inch Bars

Clear Spans	Number of Beam Saddles or Separators					
	Single Layer of Bars	Two Layers		Three Layers		
		Lower	Top	Lower	Middle	Top
Over 0 ft. to 15 ft.	2	2*	2	2*	2	2
Over 15 ft. to 30 ft.	4	5	2	6	2	2
Over 30 ft. to 45 ft.	6	7	3	9	3	3
Over 45 ft. to 60 ft.	8	9	3	11	3	3
Average spacing of supports						
All Spans.....	8′0″	7′0″	14′0″	5′0″	10′0″	10′0″

These spacings are followed in Havemeyer Reinforcement unless additional supports are required and are specially noted in the order.*

*The Concrete Reinforcing Steel Institute calls for 3-Beam Chairs in spans up to 15 feet, but this practice has been found unnecessary, and only 2 are required in Havemeyer Reinforcement.

Fig. 16. Details showing method of applying Havemeyer No. 2 Bar-Tys in assembling rectangular column frames. See Fig. 15 above.

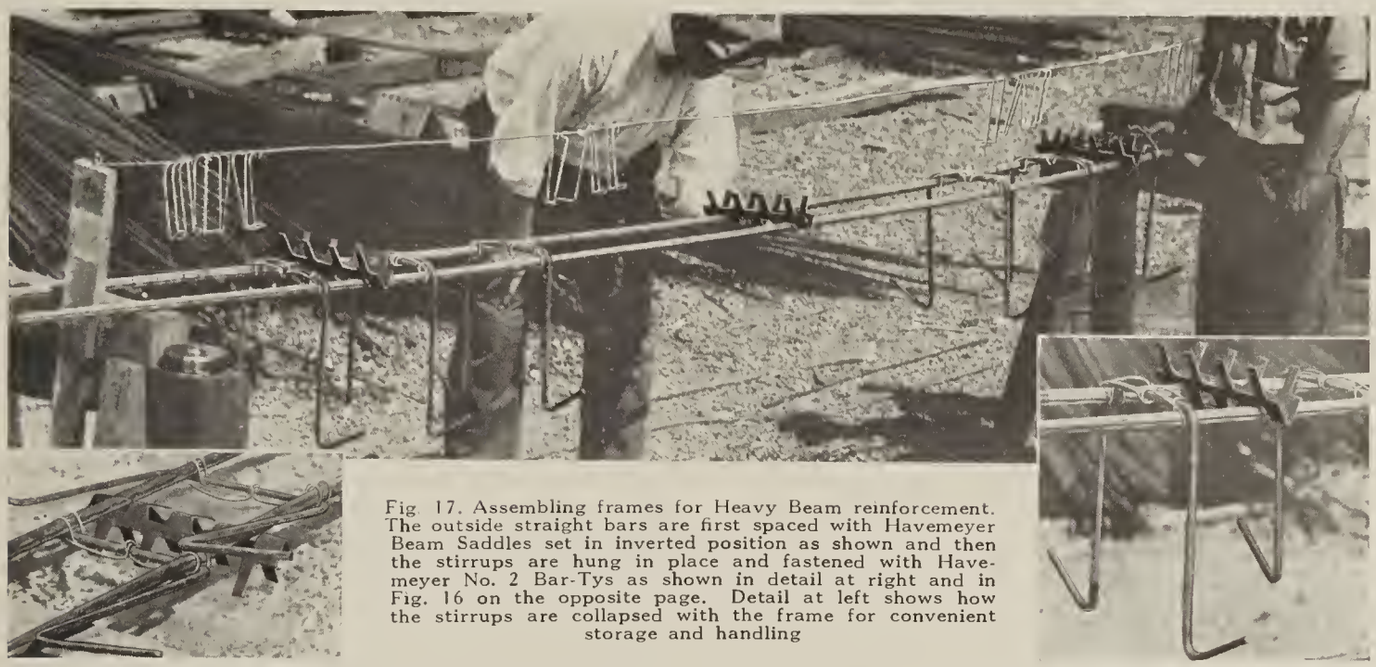


Fig. 17. Assembling frames for Heavy Beam reinforcement. The outside straight bars are first spaced with Havemeyer Beam Saddles set in inverted position as shown and then the stirrups are hung in place and fastened with Havemeyer No. 2 Bar-Tys as shown in detail at right and in Fig. 16 on the opposite page. Detail at left shows how the stirrups are collapsed with the frame for convenient storage and handling

Complete Heavy Beam reinforcement usually consists of the following members: (a) a bottom layer of straight bars; (b) one or more upper layers of bent bars; and (c) a group of stirrups near each end of the girder. The initial assembly of these reinforcing members is hereinafter called a "frame" because it consists of the outer members within which all of the other members are assembled.

Assembly of the frame is completed as follows. The two outer bars of the bottom course (usually straight bars) are laid across horses as shown in Fig. 17 and the required number of Havemeyer Beam Saddles are attached with the legs upward, at the intervals given in the above tables. The saddles have locking prongs which are bent down over the bars holding them securely in place. The two frame bars are set in the outer seats of the beam saddles and the prongs bent over them, while the prongs for the remaining intermediate bars are left raised.

The required stirrups (as specified in the design and shown in the erection details) are then hung over the frame bars at correct intervals and clipped to the frame bars with No. 2 Bar-Tys as shown in Figs. 16, 17 and 18, using the same method described above for collapsible rectangular columns. The Bar-Tys allow the stirrups to swivel so that the frames may be collapsed and piled ready for use. Note in Fig. 17 how the frames appear collapsed and stacked.

When ready to place in the form, the frames are opened up by lifting the stirrups to a vertical position, and the inside bars are placed in the beam saddles, and the prongs bent down over the bars. This can be done before placing the frame in the form, or the frame alone can be placed in the form and the inside bars can then be properly placed in the beam saddles and locked. See Figures 18 to 21 and note the true alignment of the steel.

The second layer of bars (usually bent bars) is

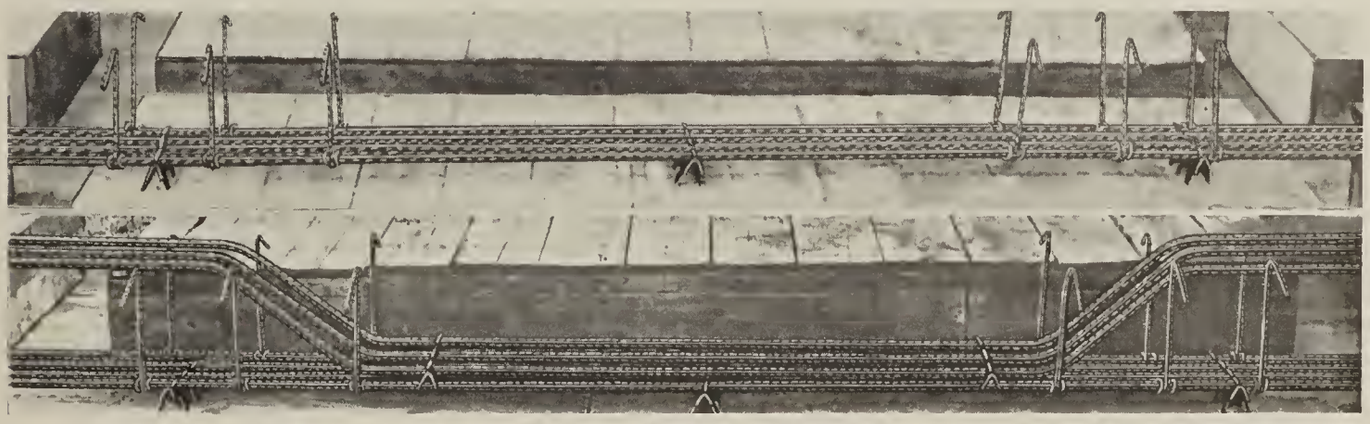


Fig. 18. Before setting the frames in the forms the remaining straight bars and the bent bars are put in place and held by beam separators and saddles as shown. The entire reinforcement is then lowered into the forms.

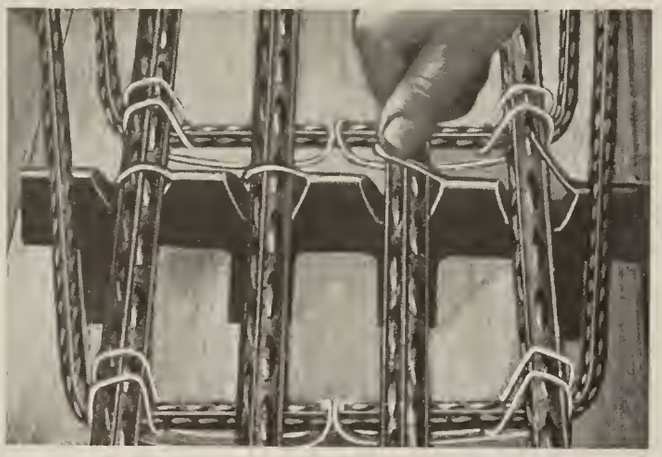


Fig. 19. Detail showing method of fastening bars in beam saddles and separators by locking the prongs. Note the position of No. 2 Bar-Tys holding the stirrups.

assembled in the beam separators in a similar manner to the bottom layer and can be placed as a unit, as described for the assembled frame with beam saddles and stirrups; or the beam saddles may be placed on top of the lower layer of bars and the individual bars lowered in their seats, locking the prongs over them as shown in figures 19, 20 and 21.

3. LIGHT BEAMS

(Ordinary Beams—Bars 1″ square and smaller)

The Concrete Reinforcing Steel Institute requires "Beam Chairs" (equivalent to Havemeyer Beam Saddles and Separators) as follows:

Ordinary Beams (Bars One (1) Inch Square and Smaller)

Clear Spans	Number of Beam Saddles or Separators					
	Single Layer of Bars	Two Layers		Three Layers		
		Lower	Top	Lower	Middle	Top
Over 0 ft. to 14 ft.	2	2	2	2	2	2
Over 14 ft. to 23 ft.	4	3	2	3	2	2
Over 23 ft.		See table on page 14				

These spacings are followed in Havemeyer Reinforcement unless additional supports are required and are specially noted in the order.

Light Beam reinforcement is assembled in exactly the same manner as Heavy Beam reinforcement described above. In single layer work the straight bars are used to assemble the frame and the bent bars are held in the intermediate seats of the Beam Saddles instead of in Beam Separators.

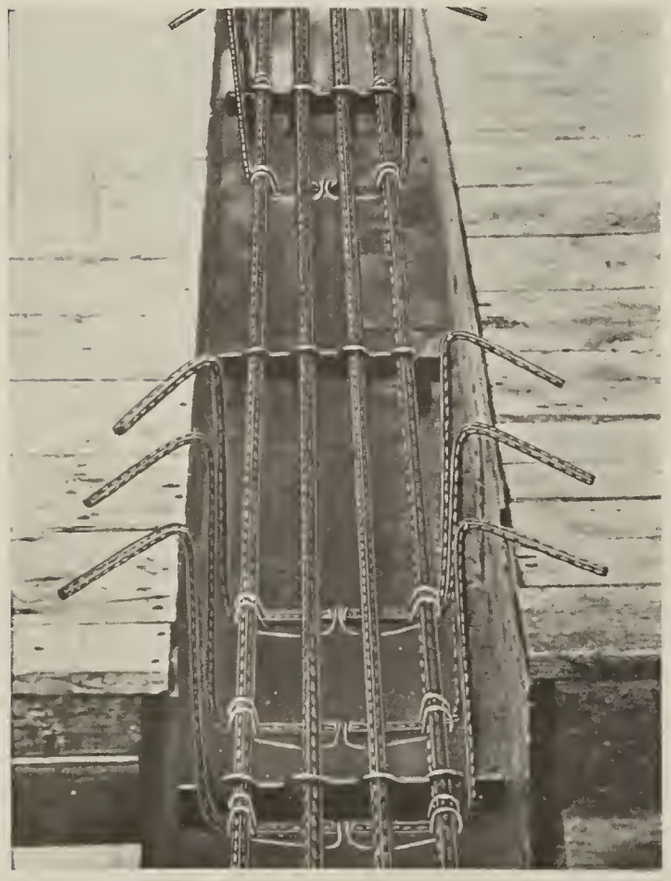


Fig. 20. Beam or girder frame with straight bars in place lowered in the forms showing accurate alignment and rigid holding resulting from the employment of Havemeyer devices.

Fig. 21. When desired, the second and upper layers of bent bars can be assembled in beam separators and lowered into the form, after the bottom layer has been set. Note perfect alignment.

4. SLABS

(Not Flat Slabs)

The Concrete Reinforcing Steel Institute Specifications require "Rib Chairs" and "Supporting Spacers" (equivalent to Havemeyer Easel-Chairs and Securo Bar Spacers) as follows:

SLABS

Ribbed Floor Slabs		*Slabs with Principal Reinforcing in One Direction*	
Clear Spans	Easel Chairs per Rib	Clear Spans	Securo Spacers
Over 0 ft. to 10 ft.	2	Over 0 ft. to 7 ft.	2 lines
Over 7 ft. to 17 ft.	3	Over 7 ft. to 17 ft.	3 lines
Over 20 ft. to 30 ft.	4	Over 17 ft. to 27 ft.	4 lines

These spacings are followed in Havemeyer Reinforcement unless additional supports are required and are specially noted in the order.

Ribbed Floor Slabs.

This designation includes floor slabs having minor beams or ribs projecting beneath the slab proper, either at right angles to each other or parallel, which carry the loads between main beams and girders.

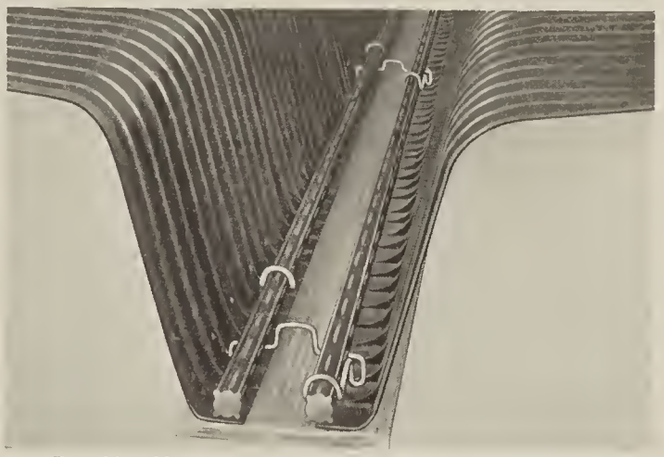


Fig. 23. Havemeyer double Easel-Chairs supporting, spacing and holding two bars in a simple beam form with Havemeyer metal centers. See also Fig. 6 on page 8.

They are frequently formed with metal tile or metal forms (see page 30 for Havemeyer Light and Heavy Gauge Steel Forms) or with terra cotta blocks laid on a flat form surface.

Where there are two reinforcing bars in the rib or joist, Havemeyer Single and Double, or Double Easel-Chairs only, are used as shown in Figs. 4, 6

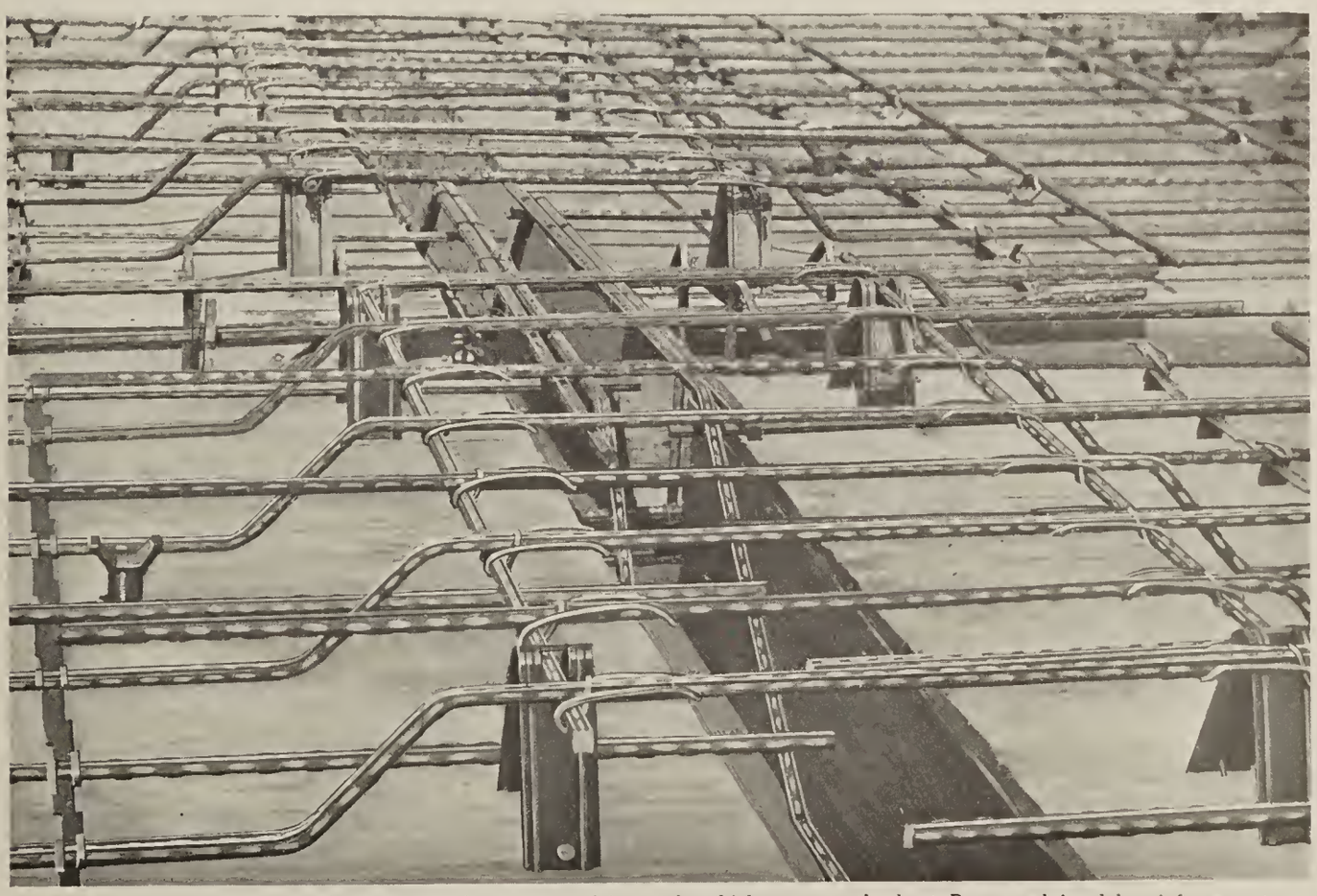


Fig. 22. Havemeyer Hy-Chairs are used to carry raising rods which support the bent Bars used in slab reinforcement over main beams and girders. The bars are clipped to the raising rods with No. 2 Bar-Tys.

and 23. Where one bar is used, Havemeyer Single Easel-Chairs are employed. These are rapidly applied to the bars by means of the simple spring clips or locking arms, and function to space the bars and to keep them the proper distance off the forms.

Where three or more bars are required Havemeyer Beam Saddles are employed as for beams. See Figs. 8, 12, and 19. The raised ends of the bent rods are supported over beams and girders in the manner described below and as illustrated in Fig. 22.

Slabs with Principal Reinforcing in One Direction.

This designation includes thick slabs having reinforcing bars, both straight and bent, running in one direction from beam to beam at regular intervals across the panel. These intervals are established and maintained, and the bars firmly held off the forms at the required clearance with the Securo Bar Spacers. These are continuous strips of hoop steel, bent at the proper distances to form legs and seats for each bar, and punched to provide two locking arms to be bent over each bar.

The Securo Bar Spacers are laid in lines on the forms at the required distances given in the foregoing table and the bars are laid across the spacers, one in each seat, and the locking arms bent over in place. A quick inspection will detect a missing bar by its absence from the chair seat.

The upper ends of the bent rods pass over the upper part of beams and girders, and are usually supported in the following manner. At intervals of 4 feet centers place a row of Havemeyer Hy-Chairs along the beam channel in the forms and nail to the forms. In the Hy-Chairs seat and lock Raising Rods each consisting of a ½″ or ⅝″ Bar of proper length as shown in Fig. 22. These are placed before the bars are laid in the Securo Bar Spacers. The bars are securely fastened to the Raising Rods with No. 2 Bar-Tys as shown.

5. FLAT SLABS

The Concrete Reinforcing Steel Institute specifications for Two-way and Four-way Flat Slabs require "Supporting Spacers" (equivalent to Securo Bar Spacers) and "High Chairs" (equivalent to Havemeyer Hy-Chairs) as shown on the next page.

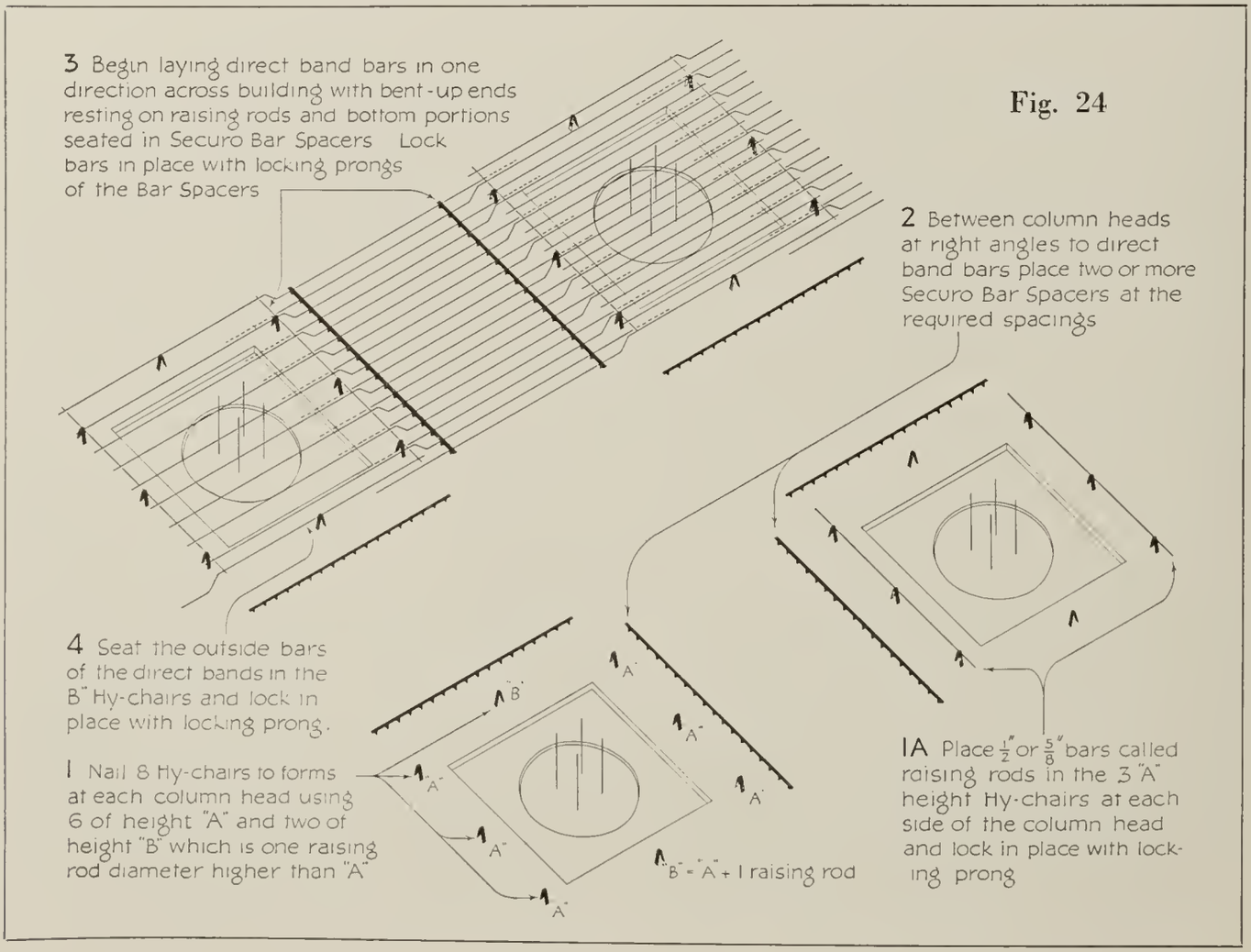

3 Begin laying direct band bars in one direction across building with bent-up ends resting on raising rods and bottom portions seated in Securo Bar Spacers Lock bars in place with locking prongs of the Bar Spacers
2 Between column heads at right angles to direct band bars place two or more Securo Bar Spacers at the required spacings
4 Seat the outside bars of the direct bands in the B" Hy-chairs and lock in place with locking prong.
1 Nail 8 Hy-chairs to forms at each column head using 6 of height "A" and two of height "B" which is one raising rod diameter higher than "A"
B" = "A" + 1 raising rod
1A Place ½" or ⅝" bars called raising rods in the 3 "A" height Hy-chairs at each side of the column head and lock in place with locking prong
A"
B"

Fig. 24

FLAT SLABS

Two and Four Way Flat Slabs

Spans (center to center of columns)	Securo Spacers		Hy-Chairs (to support 5/8 inch bar under ends of bent bars)	
	Column Strip or Direct Band	Middle Strip or Diagonal Band Bottom Layer	Support for Column Head Reinforcement	Support for Negative Reinforcement Middle Strip
Over 0 ft. to 18 ft.	3	2	.....	.....
Over 18 ft. to 26 ft.	3	3	.....	.....
Over 26 ft. to 36 ft.	4	4	.....	.....
Around Interior Columns	.....	.....	8	.....
Around Exterior Columns	.....	.....	5	.....
Around Corner Columns	.....	.....	4	.....
In Interior Panels	.....	.....	.....	8
In Exterior Panels	.....	.....	.....	10
In Corner Panels	.....	.....	.....	12

These spacings are followed in Havemeyer Reinforcement unless additional supports are required and are specially noted in the order. For additional security the use of Havemeyer Ty-Chairs in the manner noted below is strongly recommended and will be included in the schedule of materials unless otherwise directed.

Two-Way Flat Slabs.

The following sequence of operations is recommended for completing the placement of two-way reinforcement.

1. At each column head lay out 8 Hy-Chairs and nail to the form as shown in Fig. 5 and in the diagram Fig. 24. Note that 6 Hy-Chairs are of uniform height, ("A" in diagram) and 2 Hy-Chairs are higher than the others by the thickness of the bars employed. Across three Hy-Chairs at opposite sides of the column head place a ½" or 5/8" bar called a Raising Rod. The raising rods are locked in position by bending the locking prong over the bar seat. The remaining two Hy-Chairs, (marked "B" in Fig. 24) at the center point of each of the other two sides of the column head, will subsequently carry the outside bars of the first direct band, which will then function as raising rods for the opposite direct band.

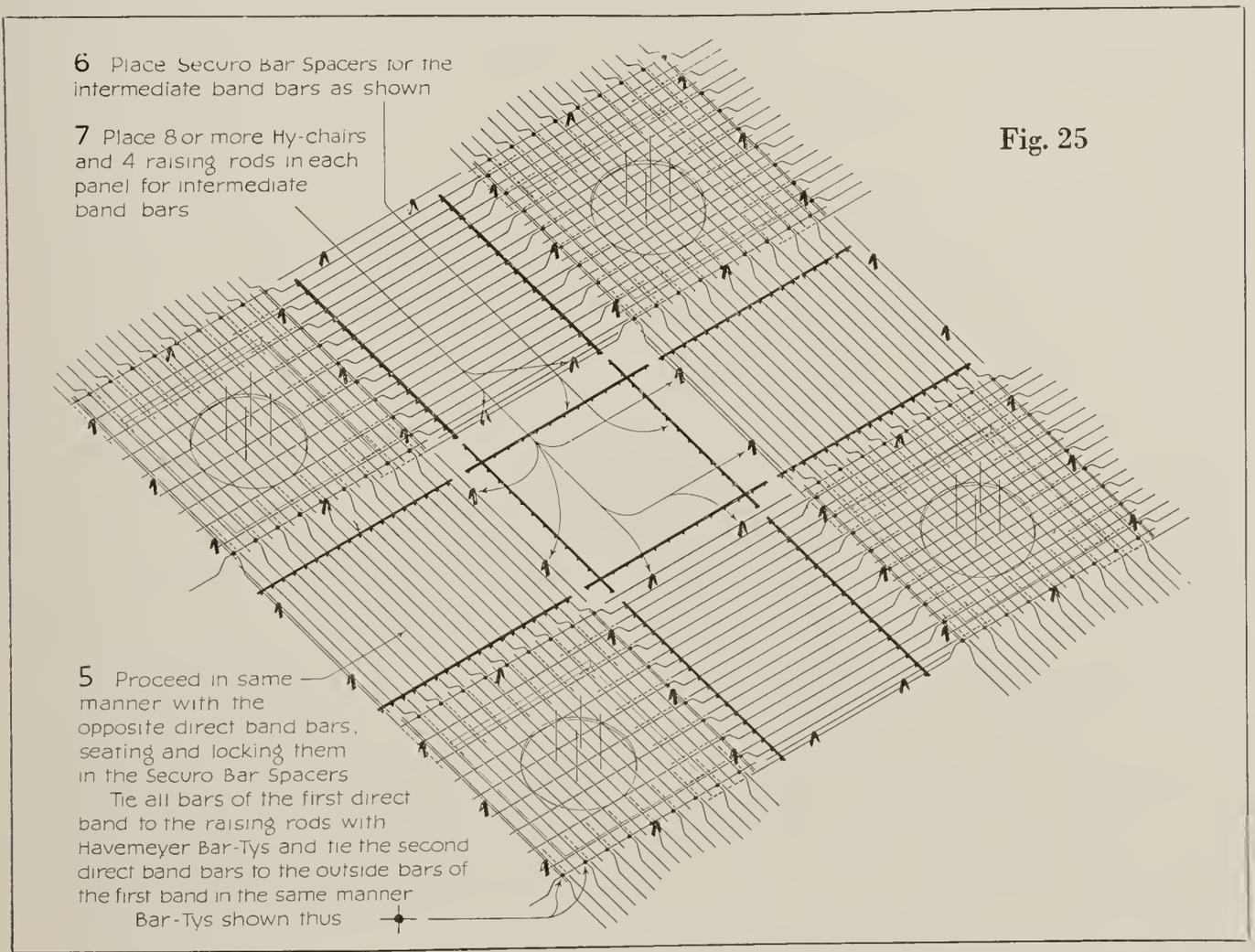

6 Place Securo Bar Spacers for the intermediate band bars as shown
7 Place 8 or more Hy-chairs and 4 raising rods in each panel for intermediate band bars
5 Proceed in same manner with the opposite direct band bars, seating and locking them in the Securo Bar Spacers
Tie all bars of the first direct band to the raising rods with Havemeyer Bar-Tys and tie the second direct band bars to the outside bars of the first band in the same manner
Bar-Tys shown thus

Fig. 25

Fig. 26. In this illustration the direct band bars in two-way reinforcement have been laid and are being clipped with No. 2 Bar-Tys to the raising rods supported by Havemeyer Hy-Chairs. Note also Securo Bar-Spacers in place.

2. Between column heads in line with the direct bands place Securo Bar Spacers at the required distances given in the above table (under supporting spacers) and as shown in the diagram Fig. 24.

3. Beginning in one direction across the building lay the first direct band bars with the bent-up ends resting across the Raising Rods at the column heads, and the lower straight sections seated in the Securo Bar Spacers. Fasten the locking prongs over each bar along each spacer. Fasten the bars to the Raising Rods with Havemeyer No. 2 Bar-Tys. See Fig. 9.

4. Seat the outside bars of the first direct band in the Hy-Chairs at each side of the column head as noted in paragraph 1, on the preceding page.

5. Proceed in the same manner with the opposite direct band bars, seating and locking them in the Securo Bar Spacers and fastening the bent ends to the outside bars of the first direct band with No. 2 Bar-Tys as in the case of the Raising Rods. See diagram Fig. 25 and the illustration Fig. 26 above. Bars may also be tied at intersections over column heads if desired.

6. The direct bands having been laid, place Securo Bar Spacers for the short span intermediate band bars as shown in Fig. 26 and in the diagram Fig. 25.

7. Next place in position 8 or more Hy-Chairs in each panel, two or more between each column adjacent to the outside bars of the direct bands and seat and lock a ½″ or ⅝″ Raising Rod in each set of Hy-Chairs. Two Hy-Chairs are used on each side in bays up to 20 feet, center to center, and three are recommended for bays over 20 feet.

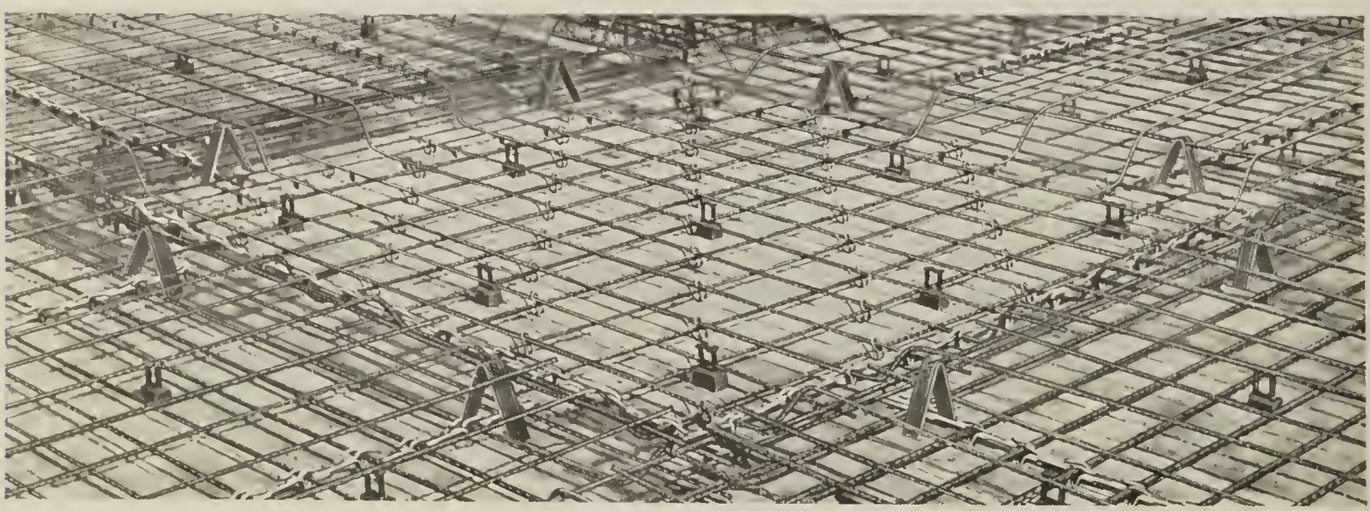


Fig. 27. Complete two-way reinforcement viewed from above one column head showing Hy-Chairs, Securo Bar-Spacers and Ty-Chairs in use as described in the text.

8. Proceed with laying the intermediate band bars across the center panels, seating and locking the bars in the Securo Bar Spacers, and tying them to the Raising Rods with No. 2 Bar-Tys as for the direct bands. See Diagram Fig. 28.

9. For additional security use Havemeyer Ty-Chairs at the intersections of every third pair of bars where small bars are employed, and at each intersection with large bars. The Ty-Chairs not only hold the bars together, but prevent their depression by the weight of the concrete mix and the tamping process, thus assuring proper embedment of the bars at all points. The method of using Ty-Chairs is shown in Fig. 29, and their disposition in Fig. 28.

Four-Way Flat Slabs.

This system of reinforcement is similar to the two-way system except that intermediate bands are replaced by diagonal bands which cross the direct bands at the column heads instead of between columns. The recommended method of placing reinforcement follows closely that described for two-way systems. The sequence of operations is as follows:

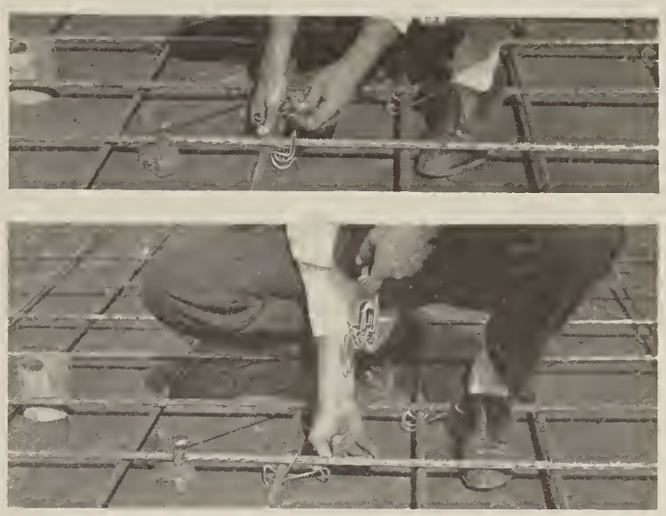
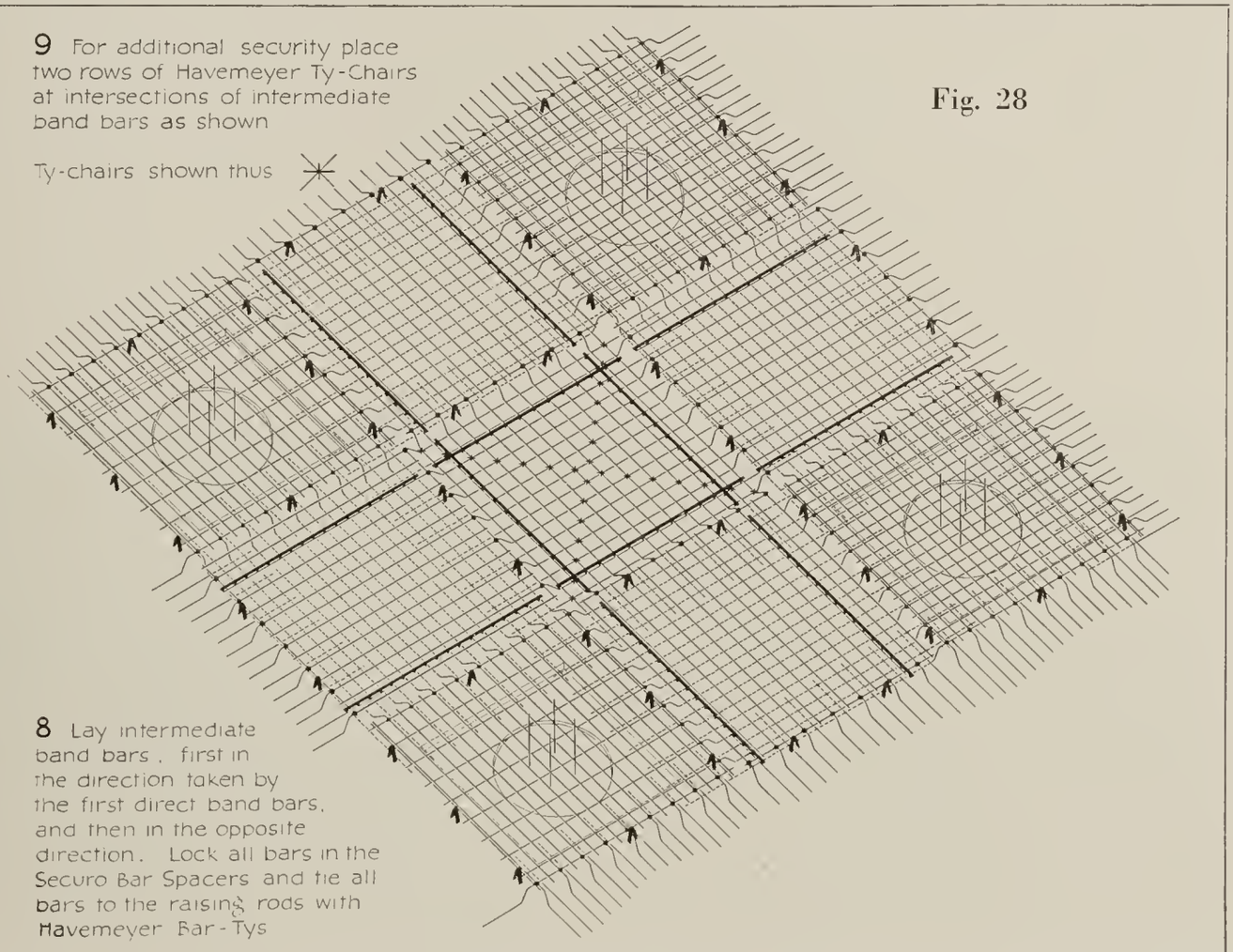


Fig. 29. Havemeyer Ty-Chairs and their method of application.

1. Proceed as for Two-way Flat Slabs to the completion of the direct bands, (paragraphs 1 to 5 inclusive on pages 19 and 20, and Figs. 24 and 25).

2. The direct bands having been laid, place Securo Bar Spacers in a diagonal position in the center panels as shown in the diagram, Fig. 30.

Fig. 28


9 For additional security place two rows of Havemeyer Ty-Chairs at intersections of intermediate band bars as shown
Ty-chairs shown thus
8 Lay intermediate band bars, first in the direction taken by the first direct band bars, and then in the opposite direction. Lock all bars in the Securo Bar Spacers and tie all bars to the raising rods with Havemeyer Bar-Tys

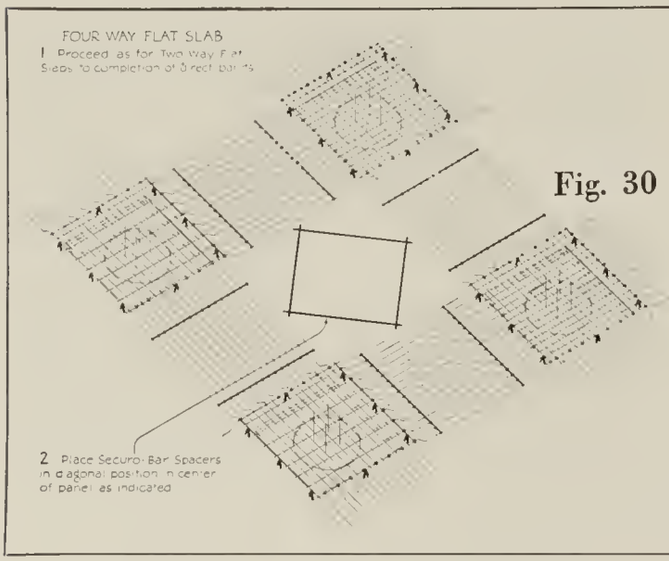

FOUR WAY FLAT SLAB
1 Proceed as for Two Way Flat Slabs to completion of direct bars
2 Place Securo-Bar Spacers in diagonal position in center of panel as indicated

Fig. 30

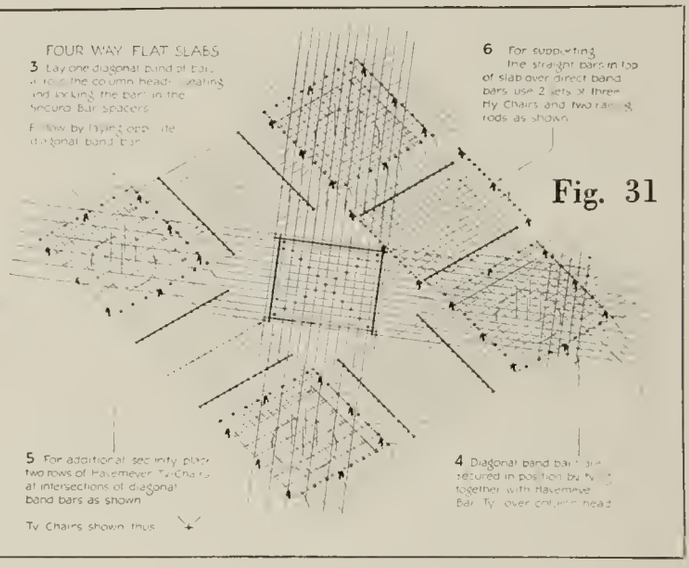

FOUR WAY FLAT SLABS
3 Lay one diagonal band of bars across the column heads seating and locking the bars in the Securo Bar Spacers
Follow by laying opposite diagonal band bar
6 For supporting the straight bars in top of slab over direct band bars use 2 sets of three Hy Chairs and two raising rods as shown
5 For additional security place two rows of Havemeyer Ty-Chairs at intersections of diagonal band bars as shown
Ty Chairs shown thus
4 Diagonal band bars are secured in position by tying together with Havemeyer Bar Ty over column heads

Fig. 31

3. Lay one diagonal band of bars across the opposite column heads, seating and locking the bars in the Securo Bar Spacers. Follow by laying the opposite diagonal band over the first diagonal band in the same manner. See Figs. 31 and 32.

4. There being no Raising Rods to support the diagonal bands other than those used to support the direct bands, the bent ends of the diagonal bands are held in position by tying them together over the column heads with No. 4 Bar-Tys.

5. Where the diagonal bands intersect in the center of the panel, use Havemeyer Ty-Chairs to hold them together and keep them above the forms at the proper distances. Use Ty-Chairs at each intersection for heavy bars and at every third intersection for light bars or as indicated in Fig. 31.

6. When the design calls for a panel of straight bars to take care of the negative moment over the center of the direct bands, this panel is held in position by means of two (or three) sets of three Hy-Chairs with raising rods as shown in Fig. 31. The straight bars are laid on the raising rods and tied with No. 2 Bar-Tys.

6. OTHER MEMBERS

In all other types of reinforced concrete structural members, including retaining and spandrel walls, arches, etc., the same supporting, spacing and holding devices may be used as above described or adapted to special problems by Concrete Steel Company engineers. Any problem you may have may be submitted without charge to our Engineering Department and special devices will be developed as required to give the same security and rigidity to the reinforcement and to accomplish the same labor and time economies which distinguish Havemeyer Reinforcement. Use this service freely.

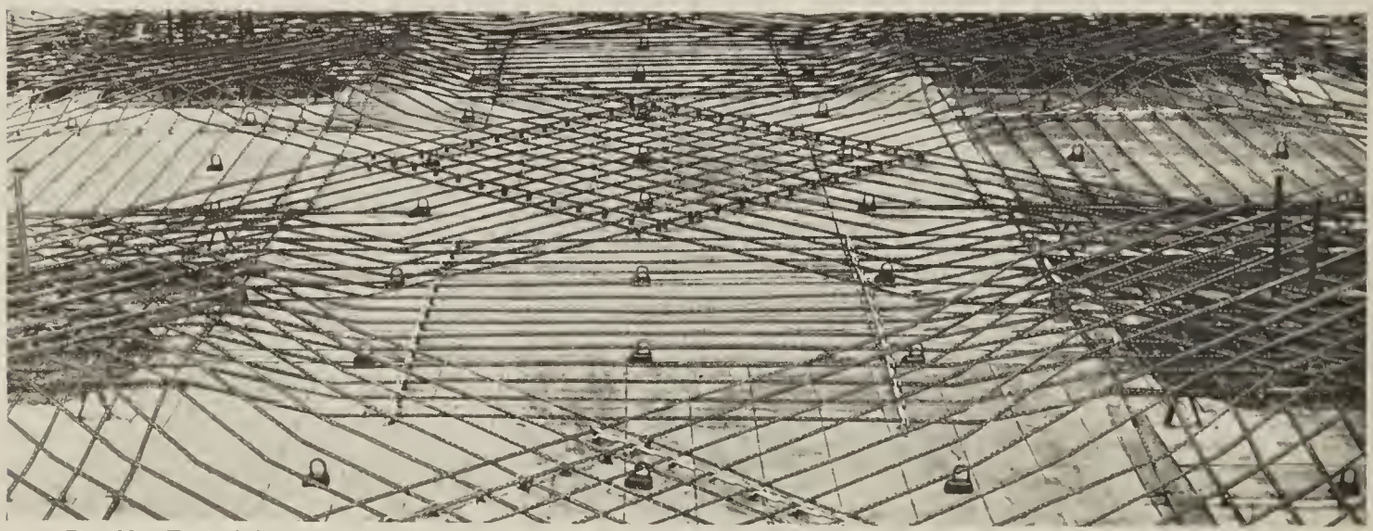


Fig. 32. Typical four-way flat slab reinforcement showing use of Hy-Chairs at the column heads and Securo Bar-Spacers to space and hold both direct band bars and the diagonal band bars. Havemeyer Ty-Chairs are also visible at the intersections of the diagonal band bars.

V. Services That Aid Economical Construction

Shop Bending of Bars to Specifications—Labeling and Packaging to Facilitate Handling on Job—Prompt Deliveries According to Schedule and Engineering Services That Assist Builder and Architect Alike—Are All Elements of Havemeyer Reinforcement.

HAVEMEYER Reinforcement is far more than a system of placing reinforcing steel, using improved methods and devices; it embraces complete service that is designed to assure the most economical and satisfactory results to builder, owner, and architect, and to reduce the time required for concrete construction by eliminating waste motion and extra work in the field.

The services available through Concrete Steel Company in conjunction with the specification and use of Havemeyer Reinforcement and Havemeyer Products generally, are described below.

Engineering Services.

Each district office of Concrete Steel Company maintains a competent engineering staff rendering the services described below. These services are offered in accordance with the Code of Standard Practice of the Concrete Reinforcing Steel Institute.

In no way is the engineering service rendered by the Concrete Steel Company intended to displace the necessary work of architects and consulting engineers. The engineering assistance rendered by the Concrete Steel Company has for its object making more speedy and more economical the handling of reinforcing steel and related products. To that end the type of engineering service falls into one of the following classes of contracts:

List. (Bar lists only.) Where the architect's plans or engineer's drawings are sufficiently complete to serve as placing plans, the engineering service of the Concrete Steel Company is limited to that of preparing bill of bent and straight bars only, except that when Havemeyer Reinforcement is specified the necessary supporting, spacing and holding devices are also listed.

Detail. (Details and bar lists.) Where the architect's plans or engineer's drawings show the complete design but are not in sufficient detail to constitute working drawings, the engineering service of the Concrete Steel Company consists in preparing detailed placing plans, showing the number, size, length, mark, location and bending diagrams for all reinforcing steel, together with bills of bent and straight bars and all supporting, spacing and holding devices separately listed as above.

Design. (Design, details, and bar lists.) Where the architect's plans do not show the structural design, the engineering service furnished by the Concrete Steel Company includes the preparation of a design in accordance with "Standard Building Regulations for Reinforced Concrete," as adopted jointly with the American Concrete Institute and promulgated by the Concrete Reinforcing Steel Institute except as may be modified by local building code restrictions or by such standard recommendations for reinforced concrete design as the architects' specifications may designate. In addition to furnishing the structural design, the Concrete Steel Company will provide detailed placing plans, together with bills of bent and straight bars and all supporting, spacing and holding devices as above.

Responsibility. Each proposal involving engineering service on the part of the Concrete Steel Company clearly specifies which of these three types is included. No responsibility can be assumed by the Concrete Steel Company for the correctness of structural designs or dimensions *furnished by others.* The Concrete Steel Company's plans are intended merely to supplement the architectural and structural plans and are to be used only in conjunction with them.

Shop Drawings. The drawings or diagrams required under the various types of engineering service above outlined are submitted in duplicate, for approval, to the owner or his appointed representative (usually the architect) who is to examine and return them. Such drawings when approved without change, are considered to be the correct interpretation of the materials to be furnished by Concrete Steel Company and to be used in the work by the contractor.

When these drawings are returned with corrections, the Concrete Steel Company engineers make the corrections indicated, and thereupon fabrication of the material is begun. Corrected copies of the Concrete Steel Company drawings (Blue Prints) in triplicate are then furnished the architect or owner for his use.

Standard charges established by the Concrete Reinforcing Steel Institute for the above engineering services are as follows:

List	.05	per hundred pounds
Detail Working Drawings	.25	" " "
Design and Working Drawings	.40	" " "
Minimum Engineering Charge	$15.00	regardless of weight

Cutting, Bending and Fabricating.

The facilities for cutting, bending, and fabricating reinforcing steel possessed by Concrete Steel Com-

Fig. 33. Power machines are used to bend bars to order in Havemeyer warehouses and shops. Shop bending is recommended for accuracy and economy.

Fig. 34. The Concrete Steel Company has unexcelled facilities for shipping bars, spirals and accessories in large or small orders.

HAVEMEYER REINFORCEMENT INCLUDES CUTTING, BENDING AND FABRICATING WHEN DESIRED

pany are unparalleled in the industry. The facilities, which are distributed among the strategically located warehouses maintained by this organization are adequate to assure immediate fabrication and shipment under any delivery schedule required by the builder.

The extent of cutting, bending and fabricating to be done for each buyer is optional and is usually determined by the relative cost of shop work as compared with field work. Under all normal conditions shop fabrication is cheaper and unless otherwise ordered, it will be assumed that all reinforcement will be delivered cut, bent and fabricated in accordance with the steel schedule and the governing drawings and specifications.

The work normally performed is as follows:

a. Straight bars; cut to length.
b. Bent bars; all bends as per detail drawings.
c. Stirrups and column ties; bent as per details.
d. Column spirals; Havemeyer Collapsible Spirals assembled with two spacers, and additional spacers where required, shipped flat.
e. Unit rectangular column reinforcing; shop fabricated (only on special order); Collapsible column frames assembled with four bars and all horizontal bands.
f. All supporting, spacing, and holding devices in which dimensions are governed by designs, fabricated to correct size for required clearances and spacing.

Bundling and Tagging. All Havemeyer Reinforcement products are carefully bundled in bundles not exceeding 150 pounds and tagged with identification tags marking each bundle with reference to its location in the structure (in accordance with the shop or erection drawings). The "Rules for Standard Practice in Bundling and Tagging" of the Concrete Reinforcing Steel Institute are strictly followed.

Deliveries. The crux of the builder's construction problem is to have the required materials on hand at the job when and as wanted. On large operations it is as difficult to receive and care for all reinforcing material before the job is ready for its placement, as it is to wait for it. Appreciating through long experience, the vital importance of "Scheduled Deliveries" in exact accordance with builders progress, the Concrete Steel Company has developed its delivery service to the highest degree of perfection. "Airspeed Service" correctly designates the smoothness, accuracy and constant reliability of Concrete Steel Company's deliveries.

When an order for Havemeyer Reinforcement or other Havemeyer Products is placed, a delivery schedule is attached to the order in which the buyer designates the dates upon which each part of the order (or the whole if desired) is to reach the job—without fail. To facilitate this work on large operations, the engineering staff schedules the required material, floor by floor, or section by section, of the work, as the nature of the job indicates. The builder, having developed a progress schedule, can thus indicate the dates upon which each stage of the work will be ready for reinforcing steel, and the whole facilities of Concrete Steel Company will be devoted to making these deliveries on time.

The following chapter is devoted to another highly important advantage and economy of Havemeyer Reinforcement,—the simplified methods of inspection which are made possible by its use.

VI. Havemeyer Reinforcement Simplifies Inspection

When Havemeyer Reinforcement is Specified as a Complete System Architects and Engineers Can Quickly Check Conformity to the Original Design

THE responsibility which Architects and Engineers must assume for the strength and safety of the buildings they design involves not only legal liability but also the loss of professional standing in the event structural weakness develops. While failure to carry out an adequate and correct design properly may shift the real responsibility to the builder, if the Architect or Engineer supervises the construction, he is still held to account. The vital necessity of supervising reinforced concrete construction to see that the original design is properly followed in placing the reinforcing steel and holding the bars in position during the process of pouring concrete is generally recognized, and anything that will simplify the inspection process, lessen the time and labor involved, and reduce the liability of error is of utmost value to the responsible designer.

From the personal point of view of the architect and the engineer, Havemeyer Reinforcement possesses the distinct and very real advantage of reducing inspection methods to a very simple routine that takes but little time and gives complete protection against error. Where Havemeyer Supporting, Spacing and Holding devices are employed, the inspector can confine his work to seeing that they are employed in the proper places and in the correct manner and that every seat contains a Havemeyer Bar of the required size. Where makeshift devices are used, with hand tying of the bars with pieces of wire, the inspector must check every bar for position and rigidity as well as size, and must follow the work through the concrete pouring and tamping process to see that no bars are displaced.

The following paragraphs give the recommended procedure for inspecting Havemeyer Reinforcement in complete detail. The actual work takes very little time and requires only the ability to read the governing drawings and specifications; in other words, the inspection work can be safely delegated by the designer to any construction supervisor or inspector.

Method of Inspecting Havemeyer Reinforcement

1. Check the Supporting, Spacing, and Holding Devices for sizes, etc.

The inspector should first examine the supporting, spacing and holding devices after they have been distributed to various parts of the job, to see that they provide the clearances and separation of the bars called for in the design of the respective members. This is to prevent the use of the wrong devices where several sizes may be employed on the same job. See page 12 for clearances required by the specifications of the Concrete Reinforcing Steel Institute.

2. Check the number and arrangement of the bar supporting and spacing devices.

The inspector should then see that the correct number of supporting, spacing and holding devices is used in each column, beam, and floor panel, and that they have been spaced at the intervals required by the drawings and specifications. See the spacing tables given on Data Sheets Nos. 1 and 2, and on pages 13 to 19 of this manual showing the recommended minimum spacing required by the specifications of the Concrete Reinforcing Steel Institute.

3. Check the size and number of bars.

Following the structural drawings, next see that the proper sizes of bars have been employed in each structural member, and that the proper number have been placed in position. This work is facilitated by the fact that if any seat in the supporting, spacing and holding devices does not carry a bar, *the omission is immediately apparent at a glance.* During this work the bends, hooks, and laps of the reinforcing bars may be checked at typical members for conformity to design.

4. Test for rigidity.

Finally test the completed reinforcement to see that it remains undisturbed by a hard shake or by walking over the bars, subjecting the members to any sort of strain equal to or greater than they will experience when the concrete is poured. At this point any movement will indicate either that the bars have not been locked into the supporting devices or that some of the Bar-Tys have been omitted. If Havemeyer Reinforcement is placed in accordance with the Standard Practice given in this manual and in the accompanying Data Sheets (Nos. 1 and 2) there should be no appreciable movement of the bars under any sort of rigidity test commensurate with the stresses likely to occur when concrete is poured and tamped in place.

These four simple tests are rapidly carried out, for in most instances a typical member or floor panel may be closely checked with a rule for sizes, placement, and clearances, and the adjacent members or panels of like character visually checked. The uniformity with which the bars are held in place by Havemeyer Supporting, Spacing, and Holding De-

vices immediately reveals any differences between members of similar character, making visual inspection adequate for most of the structure after a typical member of each type has been carefully checked as above described.

This accurate, effective, and rapid inspection which features Havemeyer Reinforcement is equally valuable to the architect, the builder and the owner, and is alone of sufficient importance to warrant its specification as a measure of insurance and economy, without considering the other advantages elsewhere noted.

The common practice among architects of intrusting the design of structural details to a consulting engineer, to the Concrete Steel Company, or to an engineer in the architect's own organization whose work does not permit him to undertake field inspection, usually places upon the architect himself or his job superintendent or clerk-of-the-works, the entire responsibility for inspecting the placing of reinforcement in accordance with designs and computations made by others. This custom often results in the architect being unfamiliar with design details and problems, though perfectly competent to make the design if circumstances required it. The ability to inspect the work of the contractor in the simple manner described above, either by the architect himself or his authorized representative, without having to call in the services of the original designing engineer, saves time and cost, and simplifies the architect's work in a measurable degree.

The builder finds the inspection feature of Havemeyer Reinforcement of value because it gives him a quick and almost automatic check on the work of his own crew and protects him from the troubles and dangers that would follow the omission or misplacement of any of the bars.

The owner is indirectly benefited through the advantages accruing to his architect and builder, and directly through the superior construction and greater safety this inspection feature affords, and the knowledge that the full designed load carrying capacity of his building will be developed and the building protected from deterioration due to insufficient protection of the reinforcing steel.

SPECIFICATIONS FOR HAVEMEYER REINFORCEMENT

Based on Modifications of the "Specifications for Reinforced Concrete in Structures" of the Concrete Reinforcing Steel Institute

Complete Specification.

Follow the "Specifications for Reinforced Concrete in Structures" of the Concrete Reinforcing Steel Institute, in full detail, making only the modifications indicated below:

Section 1. Definition of Term.
Section 2. Drawings.
Section 3. Definitions.
Section 4. Concrete Mixtures.
Section 5. Quality of Materials.

Section 5. (a) *Steel.* All reinforcing steel shall be Havemeyer Bars of intermediate grade steel, conforming to the specifications of the American Society for Testing Materials, Serial Designation A 15-14. Havemeyer Collapsible Column Spirals shall be used where indicated.

Section 6. Proportion of Ingredients and Mixing Concrete.
Section 7. Tests.
Section 8. Centering Forms and Conduits.
Section 9. Placing of Reinforcement.

Section 9. (g) *Bars Shall Be Accurately Located and Firmly Held.* All reinforcing steel shall be accurately located in the forms and firmly held in place before and during the pouring of concrete, by means of Havemeyer Supporting, Spacing and Holding devices, adequate to insure against displacement during the course of construction, and to keep the steel at the proper distance from the forms. Bar supports and spacers are to be sufficient in number, and sufficiently strong properly to carry the steel they support. The number shall not be less than the following: (*continue with tables given in this section, or substitute for the last sentence the following:* The number shall not be less than that required by the Standard Practice for Placing Havemeyer Reinforcement as given in the manual "Modern Concrete Reinforcement" of the Concrete Steel Company, and as shown in Havemeyer Reinforcement Data Sheets Nos. 1 and 2 [copies of which may be had without cost on request]; which "Standard Practice" is hereby made a part of these specifications with full force and effect).

Section 10. Placing of Concrete.
Section 11. Freezing Weather.
Section 12. Hot Weather.
Section 13. Curing.
Section 14. Superintendent.
Section 15. Exposed Concrete.
Section 16. Waterproofing.
Section 17. Treatment of Concrete Surfaces.
Section 18. Floors and Concrete Floor Finish.
Section 19. Special Provisions.
Section 20. Disputes.
Section 21. Code of Standard Practice.

Specify Complete Havemeyer Reinforcement

To Eliminate Chance of Incorrect Placement of Reinforcing Steel and to Assure Engineer's Design Is Effectively and Fully Developed

TO obtain the full benefits of Havemeyer Reinforcement it is simply necessary to incorporate in the specifications a direct statement requiring its use. There are three methods by which this may be done, depending upon the detail with which the architect desires to define the various elements of the work in the original contract documents. For each of the recommended methods there is given below and on the opposite page a form that may be conveniently followed.

1. Condensed Specification. Since the standards of practice incorporated in Havemeyer Reinforcement are based upon the specifications of the Concrete Reinforcing Steel Institute, the entire subject of reinforced concrete construction can be covered in the specifications by reference to Havemeyer Reinforcement with respect to materials and the method of placing, and to the Concrete Reinforcing Steel Institute specifications for all other matters.

2. Short Specification. When the architect desires to write into his own specifications the essential features of the complete Concrete Reinforcing Steel Institute specification, the entire section devoted to "placing reinforcement" can be omitted and reference made to Havemeyer Reinforcement, which covers the same ground.

3. Complete Specification. When the architect prefers to write out his specifications in complete form, Havemeyer Reinforcement can be specifically designated by making two brief changes and additions to the Concrete Reinforcing Steel Institute specifications, or equivalent modifications may be introduced in the architect's own standard form of specifications for reinforced concrete construction.

SPECIFICATIONS FOR HAVEMEYER REINFORCEMENT

(Note: Copies of Specifications of the Concrete Reinforcing Steel Institute can be secured through Concrete Steel Co. offices)

Condensed Specification.

General Conditions . . . . (follow standard form). . . .

Quality of Work. All reinforced concrete construction shown on the drawings or scheduled below shall be completed in accordance with the current Specifications for Reinforced Concrete in Structures of the Concrete Reinforcing Steel Institute which are hereby made a part of these specifications, having the same force and effect as if written in full herein.

Materials, and Method of Placing Reinforcement. All reinforcing steel shall be Havemeyer Bars and Havemeyer Column Spirals, which shall be placed in accordance with the Standard Practice for Placing Havemeyer Reinforcement as given in the manual "Modern Concrete Reinforcement" of the Concrete Steel Company, and as shown in Havemeyer Reinforcement Data Sheets Nos. 1 and 2 (copies of which may be had without cost on request), using Havemeyer Supporting, Spacing and Holding devices as called for therein; which "Standard Practice" is hereby made a part of these specifications with full force and effect.

Schedule of Work. . . .(here give any schedule of work that may be required). . . .

Complete Specifications, based on the "Specifications for Reinforced Concrete in Structures" of the Concrete Reinforcing Steel Institute, are given on the opposite page.

Short Specification.

Follow the Specifications for Reinforced Concrete in Structures of the Concrete Reinforcing Steel Institute, making the following changes:

Section 5 (a) *Steel.* All reinforcing steel shall be Havemeyer Bars of intermediate grade steel, conforming to the specifications of the American Society for Testing Materials, Serial Designation A 15-14. Havemeyer Collapsible Column Spirals shall be used where indicated. Material for spiral hooping shall have a yield point of not less than that required for intermediate grade steel.

Section 9. *Placing of Reinforcement.* Shop drawings, as specified in section 2, shall be submitted to the.....for approval before beginning fabrication of reinforcing materials. It is recommended that bars be shop fabricated. All reinforcing steel must be placed in accordance with the Standard Practice for Placing Havemeyer Reinforcement as given in the manual "Modern Concrete Reinforcement" of the Concrete Steel Company, and as shown in Havemeyer Reinforcement Data Sheets Nos. 1 and 2 (copies of which may be had without cost on request), using Havemeyer Supporting, Spacing and Holding devices as called for therein; which "Standard Practice" is hereby made a part of these specifications with full force and effect. (*Omit balance of Section 9.*)

INSERTS, CURB BARS AND SECURITY ANCHORS.

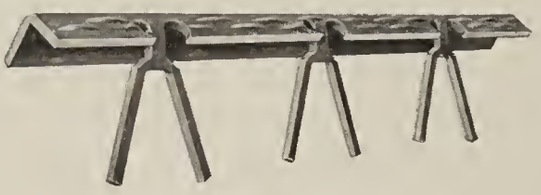
Above
Dayton Adjustable Insert No. 3 for Heavy Duty
Top Center
Dayton Adjustable Insert No. 5

Above
Havemeyer "Y" Socket Insert (Non-Adjustable)
At Left
Havemeyer Slotted Insert

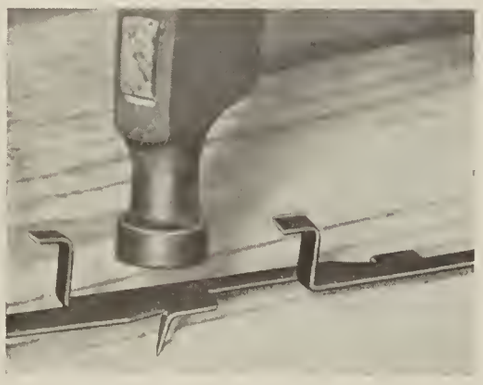
HAVEMEYER INSERTS FOR ALL SUSPENSION PROBLEMS.

Round Nose Curb Bar

CURB BARS

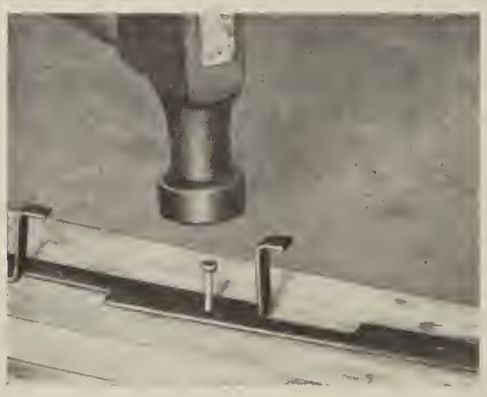


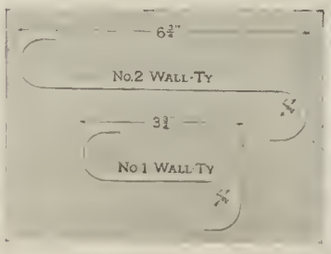
Angle Nose Curb Bar



SECURITY ANCHORS

For bonding brick or stone veneer, tile, etc., to concrete walls. Also for suspending metal lath ceilings from concrete members. Made with prongs (at left) or with nailing holes (at right) for attaching to forms.





SECURITY WALL-TYS

Used with Security Anchors as Illustrated

Havemeyer Forms, Inserts and Specialties

Inserts, Curb Bars, Wall-Tys, Security Anchors, and Removable Light and Heavy Gauge Metal Centres are Economical Accessories for Concrete Construction.

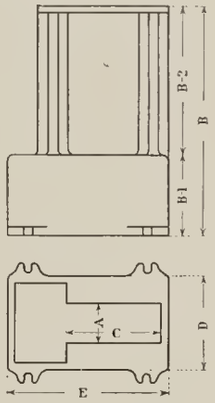
IN addition to providing the materials and rendering the services which are component parts of HAVEMEYER REINFORCEMENT, the Concrete Steel Company offers many other time and money saving materials, devices and specialties employed in reinforced concrete and fireproofed steel construction. These products have become universally recognized and are used extensively in all parts of the country.

The following paragraphs briefly describe a group of products that find frequent use on almost every building of reinforced concrete construction.

HAVEMEYER MALLEABLE INSERTS

Dayton Adjustable Insert No. 3

This heavy duty insert is made from the highest grade malleable iron cast in one solid piece. Four nailing slots are provided on the outside so that it can be firmly nailed to the form and held in place during concreting. The keyhole slot allows adjustment of the bolt. Using a ¾" bolt, this insert has been tested for 15,910 lbs. Carried in stock at all warehouses in the following sizes:



Bolt	A	B	B-1	B-2	C	D	E
¼"	5/16"	2¼"	½"	1¾"	1⅜"	¾"	2"
½"	9/16"	3¼"	⅞"	2⅜"	2"	1"	2⅞"
⅝"	11/16"	3¾"	1¼"	2½"	2"	1½"	2⅞"
¾"	13/16"	4¼"	1⅝"	2⅝"	1¾"	1¾"	2⅞"
⅞"	15/16"	4⅜"	1¾"	2⅝"	1⅞"	1⅞"	3"

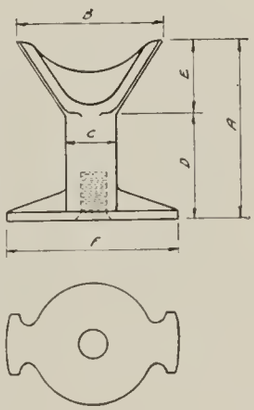
Dayton Adjustable Insert No. 5

Similar to the Dayton No. 3 Insert except of lighter construction. This type, using a ¾" bolt has been tested for 7,000 lbs. Made of one piece of highest grade malleable iron. Carried in stock in the following sizes: (See above diagram for dimensions).

Bolt	A	B	B-1	B-2	C	D	E
⅜"	7/16"	2"	⅝"	1⅜"	1⅜"	¾"	2⅛"
½"	9/16"	2⅜"	¾"	1⅝"	1½"	1"	2⅜"
⅝"	11/16"	2¾"	⅞"	1⅞"	1⅝"	1¼"	2⅝"
¾"	13/16"	3⅛"	1"	2⅛"	1¾"	1½"	2⅞"

Havemeyer "Y" Socket Insert

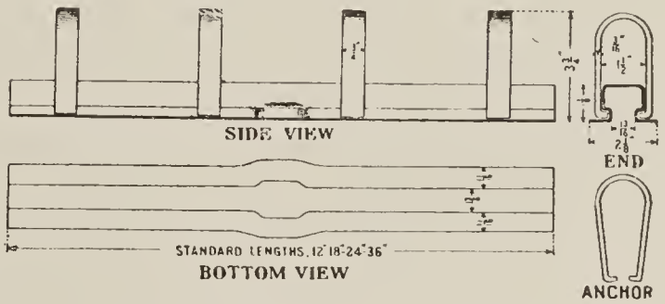
These non-adjustable inserts are cast in one piece from highest grade malleable iron and are provided with four nailing slots for attachment to forms. The spreading anchors are embedded sufficiently deep in the concrete to give a very strong grip. These inserts are tapped and threaded for standard machine bolts and are used to suspend piping, sprinklers, etc., where adjustment is not essential. Extensively used to attach wood beams or sleepers to ceiling for suspension of shafting. Carried in stock at all warehouses in the following sizes:



Bolt	A	B	B-1	B-2	C	D	E
⅜"	7/16"	2"	⅝"	1⅜"	1⅜"	¾"	2⅛"
½"	9/16"	2⅜"	¾"	1⅝"	1½"	1"	2⅜"
⅝"	11/16"	2¾"	⅞"	1⅞"	1⅝"	1¼"	2⅝"
¾"	13/16"	3⅛"	1"	2⅛"	1¾"	1½"	2⅞"

Havemeyer Slotted Inserts

These inserts are made from 15 gauge sheet steel pressed into shape in lengths of 12", 18", 24" and 36". They are adjustable over their entire length and by removing the end caps they can be set together to form a continuous slot. The standard type uses a ¾" bolt. Smaller bolts can be employed by inserting washers and a special size for ⅞" bolt can be furnished on order. These inserts have been tested with a ¾" bolt for 12,400 lbs.



HAVEMEYER CURB BARS

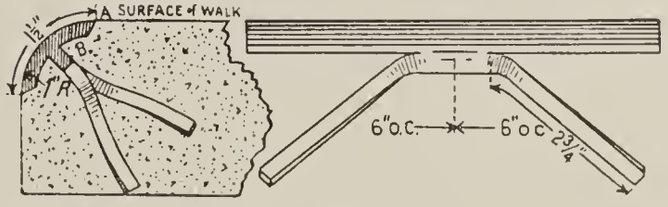
To protect corners and edges of concrete construction from wear, abrasion and chipping, Havemeyer Curb Bars should be specified.

Havemeyer Round Nose Curb Bar

This improved curb bar has staggered and flared anchors which not only hold firmly, but reinforce the concrete as well. There is no continuous web to cause splitting or weakening of the concrete. Note at point A in the drawing below that the edges are rolled sharp so that no fillet forms at this troublesome point when troweling the concrete.

Easily installed; shipped in neat bundles; machine bent to order at our warehouse at correct angle to fit tangents. These bars give full protection.

Carried in stock in 8, 10 and 12 foot lengths, galvanized. Cut to length and bent on order.



Havemeyer Angle Nose Curb Bar

The Curb Bar with the non-slip safety edge. Have-

meyer Angle Nose Curb Bars are rolled from 1¼ x 1¼ x 3/16″ angles with anchors every 6″ sheared and punched from the top leg, which is also rolled with three rows of lugs for added wear and to prevent slipping. Used for shipping platform edges and stair nosings. Carried in stock in 10 foot lengths, galvanized. Cut to length and bent on order.

HAVEMEYER SECURITY ANCHORS

Havemeyer Security Anchor is a device for bonding brick veneer, terra cotta, stone or tile wainscoting and plaster to concrete surfaces, and also for suspending metal lath ceilings from concrete members. It is made from ⅝″ x 16 gauge hoop steel, dipped, and is furnished in 8 foot standard lengths with self-contained anchor arms and either nailing barbs or nailing holes.

The anchor is nailed to the forms so that the lugs extend into the concrete and the base strip is exposed when the forms are removed. In use a loop is formed by driving a tool under the exposed metal strip wherever desired and Wall-Tys are then inserted in the loop at the level of the masonry joint into which the Wall-Tys are to be bonded. See illustrations on page 28. This device is similarly used for anchoring metal lath, ceilings, and is occasionally employed as a means of attaching wood sleepers to the surface of concrete floors.

HAVEMEYER HEAVY GAUGE METAL CENTRES

These Havemeyer Metal Centres are long-span, removable steel forms or centres for forming ribbed concrete floors. They are made of 11 and 12 gauge steel and are load-bearing, easily handled, economical in material, labor, space, and time. They are adaptable to all types of buildings.

Their principal economy is derived from the fact that their extra weight and strength permit them to be supported with a minimum number of temporary supports and because they are designed to permit quick removal without re-shoring. They are made in the following three types:

20″ wide by 13½″ deep with corners bent to a 2″ radius, allowing any depth of joist under the slab up to 12″.

31″ wide by 10½″ deep with corners bent to a 6″ radius, allowing any depth of joist under the slab up to 9″.

31″ wide by 16½″ deep with corners bent to a 6″ radius, allowing any depth of joist under the slab up to 15″.

The large radius on the 31″ centres so stiffens the slab that the same depth of slab may be used with a 31″ centre as with a 20″ centre. In fact, the actual width of the thin portion of the slab is only 19″.

Havemeyer Heavy Centres are carried in stock lengths of 5′0″, 6′0″, 7′0″, 8′0″, 9′0″ and 10′0″ but can be supplied in shorter lengths where required for special purposes.

These centres are rented to contractors by the Concrete Steel Company, for a charge based on the area for which they are to be used. Full stocks are carried in our eastern warehouses.

HAVEMEYER REMOVABLE STEEL TILE

Havemeyer Removable Steel Tile are made of 16-gauge metal with shallow corrugations at intervals across the top surface for additional strength and rigidity. They are removable, easily handled, flexible in their adaptation to all requirements and fully adjustable.

They are used in the same manner as Havemeyer Heavy Gauge Metal Centres, but being of lighter weight, require supports at somewhat shorter intervals. They are made in three standard widths, of 10″, 15″, and 20″, and in five depths, of 6″, 8″, 10″, 12″, and 14″. A number of special sizes and endforms are available.

Write for complete details. Stocked in our Chicago and western warehouses.

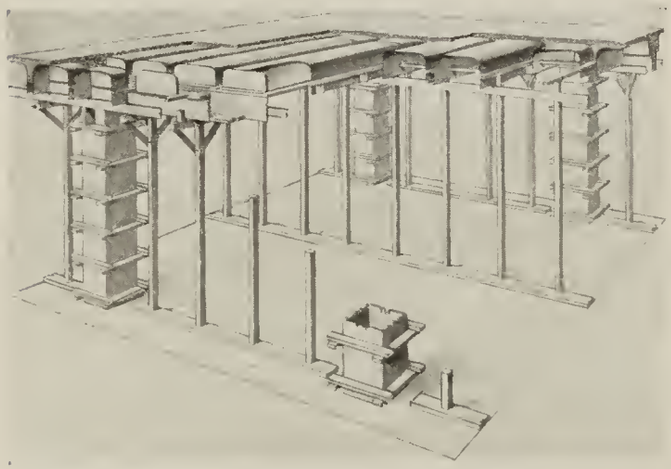


Diagram showing the use of Havemeyer Heavy-Gauge Metal Centres. These long-span, load bearing Centres require the minimum of shoring, providing ample space for working beneath the forms. Simplicity of erection and ease of removal without reshoring are labor saving features.

Interior of a ramp type garage showing a typical ribbed floor construction of the type developed with Havemeyer Metal Centres and Steel Tile. The underside of the floor may be finished and decorated or a metal lath ceiling may be applied, using Security Anchors cast into the beams.

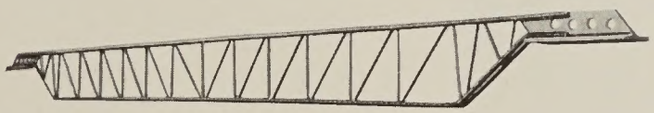
PRODUCTS OF CONCRETE STEEL COMPANY

A Complete Line of Metal Products for the Economical and Rapid Construction of Fireproof Buildings and Concrete Roads.

HAVEMEYER reinforcement and the accessory products described in this manual meet the requirements of builders erecting reinforced concrete structures. Other products of the Concrete Steel Company are similarly adapted to other types of construction. The important types of materials comprising the complete Havemeyer line are briefly outlined below. (See following page for lists.)

HAVEMEYER TRUSSES

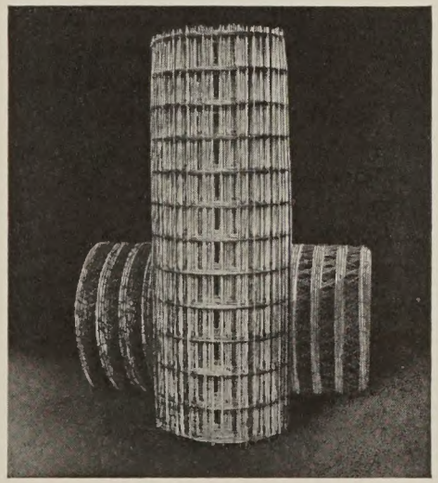
These members are employed for light weight concrete floor and roof construction in buildings having floor loads up to 125 and 150 pounds per square foot. Their construction and methods of use are fully illustrated and described in a special manual "Structural Economies for Concrete Floors and Roofs." A copy of this 32-page book will be sent without obligation upon request addressed to our nearest sales office.



Havemeyer Trusses are made in standard sizes to meet all spans from 4 feet to 31 feet, inclusive.

HAVEMEYER ELECTRIC WELD FABRIC

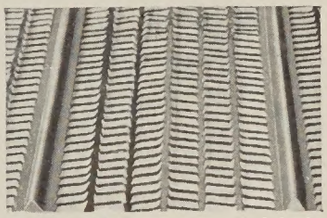
For the reinforcement of concrete slabs in building construction, minor roadways, sidewalks, and in other places where a light reinforcement is required. Havemeyer Electric Weld Wire Mesh and Triangle Wire Mesh are available. Also extensively used for temperature reinforcement in thin slabs, and for fireproofing steel columns and beams. These materials are manufactured in various weights and spacings of wires, offering a wide range of sectional areas of steel. Communicate with our nearest sales office for complete data.

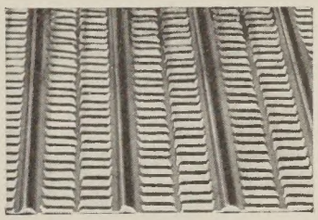


Electrically Welded and Triangle Wire Mesh for reinforcing concrete slabs of all types, plain or galvanized, in all sizes and weights.

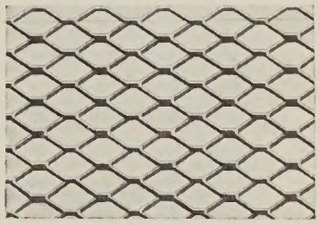
FIREPROOFING PRODUCTS

The Havemeyer line includes all types of metal lath, expanded metal, corner beads, channels, angles, and similar products used in the construction of fireproof dwellings and buildings of all types. Send for catalog of Havemeyer Fireproofing Products.





Above. Havemeyer metal lath is available in all types and weights, and in painted, galvanized, copper bearing steel, or pure iron.



Havemeyer sheet lath and expanded metal is available in all sizes and weights.

ROAD PRODUCTS

Concrete Steel Company has developed many important advances in the design and reinforcement of concrete pavements for roads and highways. The Havemeyer Barmat made of standard Havemeyer Deformed Bars materially lowers the cost of paving reinforcement. The Hoosier Asphalt Expansion Joint is the ideal material for protecting the joints in concrete slabs. Havemeyer devices for supporting deformed bar reinforcement in pavements, offer the same advantages in this field as similar devices offer in Havemeyer Reinforcement of concrete structures. A special manual called "Economical Concrete Road Reinforcement" is available on request

Havemeyer Barmats save time, labor, and cost.

ONE PURCHASE—ONE RESPONSIBILITY

THE chief aim of Havemeyer Reinforcement is to simplify the work of contractors and architects and to develop real economies through intelligent assistance and "Airspeed Service" to the builder. The same values apply to all Concrete Steel products. When in need of any of the materials listed below, communicate with our nearest Sales Office or dealer and let us relieve you of the responsibility for getting goods to you when and as wanted.

CONCRETE CONSTRUCTION

Havemeyer Deformed Bars
Collapsible Column Spirals
Havemeyer Supporting, Spacing and Holding Devices for Bars
Welded and Triangle Wire Mesh
Expanded Metal
Security Anchors and Wall Ties
Inserts
Curb Bars
Havemeyer Metal Centers
Havemeyer Removable Steel Tile

HAVEMEYER TRUSSES

for Concrete Floors and Roofs

HAVEMEYER REINFORCEMENT

One Purchase
One Responsibility

✓ Engineered Plans
✓ All reinforcing material
✓ Complete cutting and bending
✓ All spacing and holding devices
✓ Scheduled deliveries floor by floor
✓ Field Engineers
✓ One billing schedule

FIREPROOFING PRODUCTS

Metal Lath of all Types
Corner Beads
Metal Screeds
Expanded Metal Specialties
Furring Channels and Shapes
Welded and Triangle Wire Mesh
Security Anchors and Wall Ties

ROAD CONSTRUCTION

Welded Barmats
Road Reinforcing Bars
Supporting and Installing Devices
Metal Parting Strip
Hoosier Expansion Joint

SALES OFFICES:

AKRON, P. O. Box 2717, Firestone Park Sta.
BIRMINGHAM, P. O. Box 1869
BOSTON, 294 Washington St.
CHICAGO, Monadnock Block
DETROIT, Lincoln Bldg.
MINNEAPOLIS, Builders Exchange
PHILADELPHIA, Pennsylvania Bldg.
PITTSBURGH, Union Trust Bldg.
ST. PAUL, 958 Berry Avenue
SYRACUSE, 210 E. Fayette St.
WASHINGTON, 2525 Penna. Ave., N. W.

WAREHOUSES: YOUNGSTOWN, CAMDEN, BIRMINGHAM, CHICAGO, DETROIT, BOSTON, WASHINGTON, NEW YORK, ST. PAUL

CONCRETE STEEL COMPANY

Executive Offices, 42 BROADWAY, NEW YORK, N. Y.

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